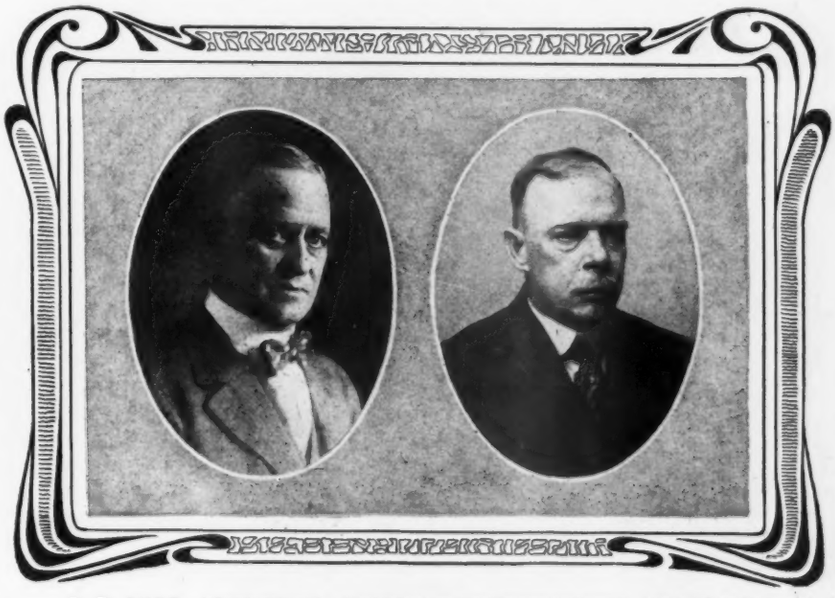
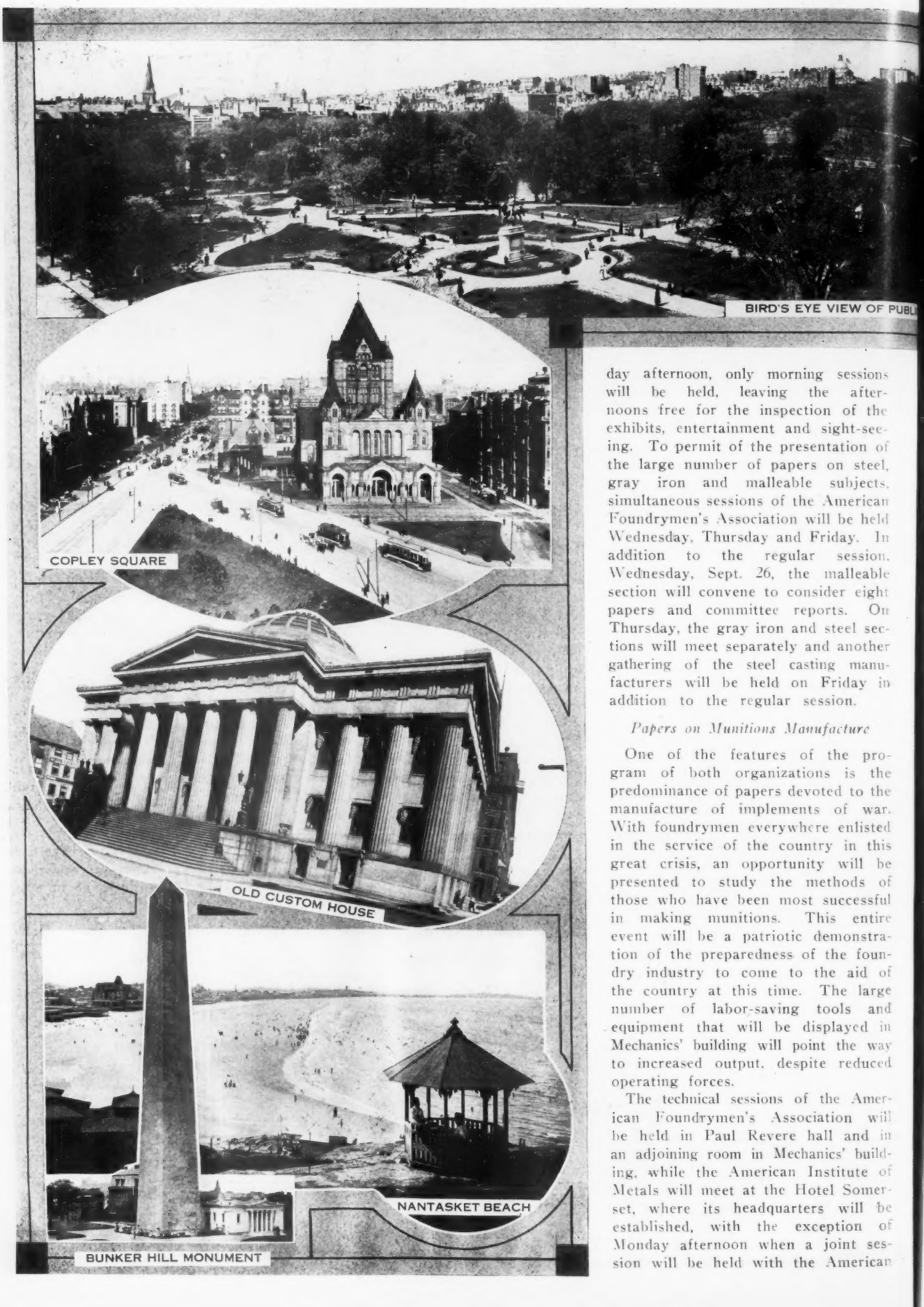
Boston Welcomes the Great Army of Foundrymen

Wonderful Programs Dealing With Every Phase of Foundry Work Have Been Prepared by the Two Technical Associations—The Exhibition and Entertainment Features

BOSTON is the Mecca that will attract the great army of American foundrymen to New England the week of Sept. 24. The concurrent meetings of the American Foundrymen's Association and the American Institute of Metals, and the exhibition of foundry supplies and equipment, machine tools and accessories, will mark an historical event in the industrial life of that wonderful northeastern community. Fifteen years have elapsed since the hospitality of New England was tendered to the casting manufacturers of North America. In 1902, the group of foundrymen who gathered in the metropolis of the Commonwealth of Massachusetts represented the results of six years of organization work by the American Foundrymen's Association. The attendance was less than 300 and in three days the entire business of the meeting was finished. What a wonderful change has taken place in the casting industry since that time is best reflected by a comparison of this affair 15 years ago and today. The attendance has grown from less than 300 to 3000, and more. The exhibits which formerly were limited to placards in hotel corridors have grown to such dimension that they tax the capacity of the most spacious halls in the country's largest cities. The one society has developed into two, the American Institute of Metals being the outgrowth of the brass section of the American Foundrymen's Association. The membership of the latter organization also has grown five-fold, until it numbers among its active supporters the most progressive foundrymen, not only of the United States, but Canada and other foreign countries as well. Since its first meeting in Boston, the American Foundrymen's Association has taken the lead among the societies of casting manufacturers and has made a place for itself in the front rank of the technical bodies of the world. This year five days will be required to dispose of the many features of its lengthy program, involving a total of eight sessions. The American Institute of Metals will hold four meetings, in addition to the joint opening session on Monday, Sept. 24. The program of the American Foundrymen's Association schedules 51 addresses, papers and committee reports and the Institute of Metals, 37. Aside from the opening meeting on Mon-



J. P. PERO, PRESIDENT, AMERICAN FOUNDRYMEN'S ASSOCIATION. JESSE L. JONES (RIGHT), PRESIDENT, AMERICAN INSTITUTE OF METALS



day afternoon, only morning sessions will be held, leaving the afternoons free for the inspection of the exhibits, entertainment and sight-seeing. To permit of the presentation of the large number of papers on steel, gray iron and malleable subjects, simultaneous sessions of the American Foundrymen's Association will be held Wednesday, Thursday and Friday. In addition to the regular session, Wednesday, Sept. 26, the malleable section will convene to consider eight papers and committee reports. On Thursday, the gray iron and steel sections will meet separately and another gathering of the steel casting manufacturers will be held on Friday in addition to the regular session.

Papers on Munitions Manufacture

One of the features of the program of both organizations is the predominance of papers devoted to the manufacture of implements of war. With foundrymen everywhere enlisted in the service of the country in this great crisis, an opportunity will be presented to study the methods of those who have been most successful in making munitions. This entire event will be a patriotic demonstration of the preparedness of the foundry industry to come to the aid of the country at this time. The large number of labor-saving tools and equipment that will be displayed in Mechanics' building will point the way to increased output, despite reduced operating forces.

The technical sessions of the American Foundrymen's Association will be held in Paul Revere hall and in an adjoining room in Mechanics' building, while the American Institute of Metals will meet at the Hotel Somerset, where its headquarters will be established, with the exception of Monday afternoon when a joint session will be held with the American

GARDEN AND COMMON, BOSTON

STATE HOUSE

FANEUIL HALL

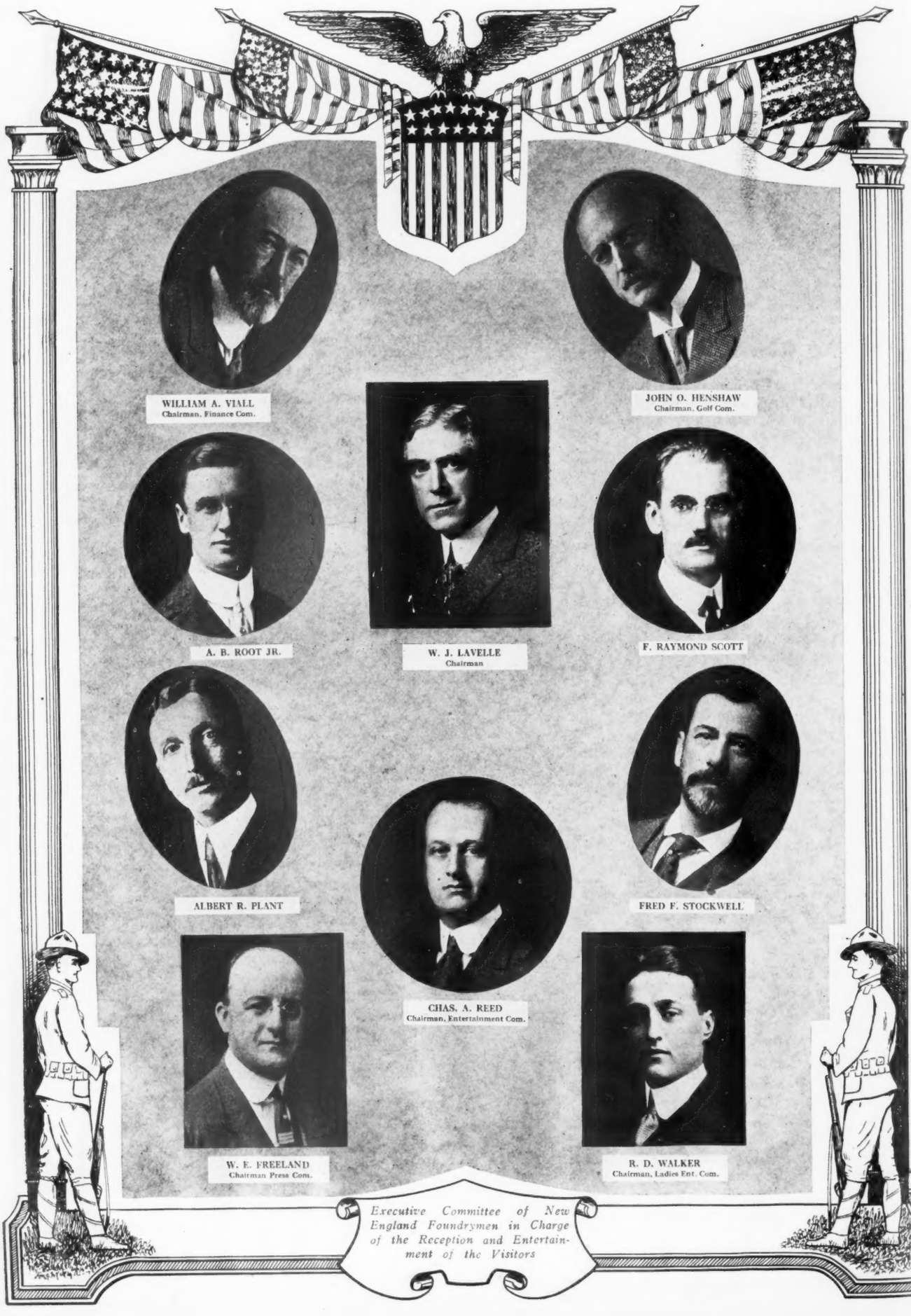
COMMONWEALTH PIER

Foundrymen's Association in Paul Revere hall. Registration for both societies will be in Mechanics' building throughout the week, and the headquarters for the American Foundrymen will be at the Copley-Plaza hotel.

The Great Exhibition

The exhibition of foundry supplies and equipment, machine tools and accessories, in Mechanics' building, will be formally opened Monday at 1 p. m. In extent and number of exhibits, it will greatly surpass the show at Cleveland last year. The operating exhibits will be grouped in sections in Mechanics' building, and the display of molding machines and machine tools promises to eclipse anything of its kind ever undertaken. Mechanics' building practically will be converted into a large foundry and machine shop and demonstrations will be made of the operating and economy-producing features of the latest and most modern equipment.

An entertainment program has been outlined by the foundrymen's committee that measures up to the noted hospitality of New England. On Tuesday afternoon the visitors will be taken on a boat ride in and about Boston harbor, with a stop at Nantasket beach. Wednesday afternoon the foundrymen will be guests at Fenway park to witness a baseball game between the Boston and Cleveland American League teams and in the evening they will attend Keith's theater. Thursday afternoon the General Electric Co. will entertain the visitors at its West Lynn plant where luncheon will be served. The annual banquet will be held Thursday evening at the Copley-Plaza hotel. Two speakers of national reputation will deliver patriotic addresses and the entertainment features will be in accord with the occasion. While facili-



Executive Committee of New England Foundrymen in Charge of the Reception and Entertainment of the Visitors

ties for plant visitation will be afforded throughout the week, Friday has been specially set apart for this feature. The Walker & Pratt Mfg. Co. will permit of an inspection of its large stove plant at this time and a similar opportunity was presented to the visiting foundrymen at Boston 15 years ago. During this period these works have undergone remarkable development, as illustrated and described elsewhere in this issue.

Ladies' Entertainment

For the ladies an extensive program of entertainment also has been provided. They will be the guests of the New England foundrymen on the boat ride on Tuesday, at Fenway park Wednesday afternoon and at Keith's theater in the evening. Thursday noon they will be tendered a luncheon to be followed by a sight-seeing automobile trip and in the evening they are specially invited to the banquet at the Copley-Plaza hotel, nearly 150 having availed themselves of this opportunity at Cleveland last year.

New England as a Foundry Center

New England, entering its 275th year in the casting of metals, has attained a position in the foundry industry of the United States which bids fair to remain unshaken as long as manufacturing retains its firm grip on the north Atlantic coast. Of the 6000-odd foundries in the country at the present time, over 600, or about 10 per cent are situated in the states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. Gray iron and brass castings were among the earliest products of the New England colonies, and in 1916 the number of iron and nonferrous casting plants in the six states aggregated more than 10 per cent of the total number in the United States. Malleable iron and steel castings were introduced in New England many years after the other branches of the foundry industry had become firmly established. Only 5 per cent of the steel foundries, and 9 per cent of the malleable plants of the country are located in the New England states.

The first iron foundry in New England was built on the west bank of the Saugus river, near the present site of Lynn, Mass. According to early records, the village which grew up around the foundry was called Hammersmith, after a town in England from which several of the workmen had come. Joseph Jenks is reported to have cast "a small iron pot, capable of containing about one quart", which is thought to have been the first casting made in New England. The iron was smelted from bog ore obtained from the low-lying swamp land in what is now eastern Massachusetts.

Hollow-ware was cast as early as 1724 near Taunton, Mass., and in 1725 the foundry was casting hollow vessels varying in size from a pint kettle up to a "10-pail" cauldron. The foundry was rebuilt in 1816, and at the end of that year 30 men were employed at the plant. The product was carried to New York in sloops which brought back pig iron and ore from New Jersey.

These foundries were the forerunners of many others which came into existence in the eighteenth century. In 1784 there were 76 iron works in New England. Although many of these were bloomeries and forge shops, it is thought that about 20 were engaged in making castings. In the north end of Boston, Paul Revere established a bell and cannon foundry which was in operation until 1801, when he erected a copper-rolling mill at Canton, Mass. Hugh Orr operated a foundry at Bridgewater, Mass., before the revolution. Cannon were cast solid and then bored in this shop, and machinery castings were made. In 1829 the first stove foundry in the United States was erected at Taunton, Mass., and in a few years the making of castings for stoves and heating appliances became an important industry.

Foundries in Revolutionary Period

The development of the foundry industry from the time of the American revolution was influenced to a considerable extent by the gradually changing economic position of New England in the United States. Massachusetts, Connecticut and Rhode Island, which for many years had provided the other states with practically all of the manufactured goods which they used, were obliged to relinquish their hold on several important industries. The blast furnaces of Salisbury gave way to those in the Pittsburgh district, and several other lines of manufacturing were established in the west where raw materials were more easily obtained. In the meantime, however, the Yankee ingenuity of the New Englanders had given them a firm hold on certain industries, many of which are peculiar to New England to this day. Clocks, small tools, hardware, paper, cotton and woolen cloth, paper, silverware and fine machine tools and brass goods became the principal products, and it is to the success achieved in producing these articles that the foundry industry in New England owes its prosperity.

In general, the majority of New England foundries are engaged in making castings for the machinery which produces the typical products enumerated, and in providing rough castings from which the products are made. The output of many foundries is required to supply the 900 boot and shoe manufacturing establishments of Massachusetts with the necessary machine equipment. This is also true of the hundreds of textile plants, the

Condensed Program

Monday, Sept. 24

10:00 A. M.—Registration, Mechanics' building.

1:00 P. M.—Opening of the exhibition, Mechanics' building.

3:00 P. M.—Joint opening session, American Foundrymen's Association and American Institute of Metals, Paul Revere hall, Mechanics' building.

Tuesday, Sept. 25

9:30 A. M.—Professional session, American Institute of Metals, Hotel Somerset, for the discussion of the melting and casting of nonferrous metals.

10:00 A. M.—Professional session, American Foundrymen's Association, Paul Revere hall, Mechanics' building; general topics.

1:30 P. M.—Boat ride, in and about Boston harbor. Luncheon will be served on board.

Wednesday, Sept. 26

9:30 A. M.—Professional session, American Institute of Metals, Hotel Somerset, for the discussion of the uses of nonferrous metals for munitions.

10:00 A. M.—Professional session, American Foundrymen's Association, Paul Revere hall, Mechanics' building; cost-keeping in foundries and general topics.

10:00 A. M.—Malleable session, Mechanics' building.

3:00 P. M.—Baseball game, Fenway park, Boston and Cleveland American League teams.

8:15 P. M.—Theater party.

Thursday, Sept. 27

9:30 A. M.—Professional session, American Institute of Metals, Hotel Somerset, for the consideration of the testing of metals.

10:00 A. M.—Gray iron session, American Foundrymen's Association, Paul Revere hall, Mechanics' building

10:00 A. M.—Steel session, American Foundrymen's Association, Mechanics' building.

12:00 M.—Luncheon for the ladies, followed by an automobile sightseeing tour.

12:30 P. M.—Visit to the West Lynn plant of the General Electric Co. Lunch will be served at the works.

7:00 P. M.—Annual banquet, Copley-Plaza hotel.

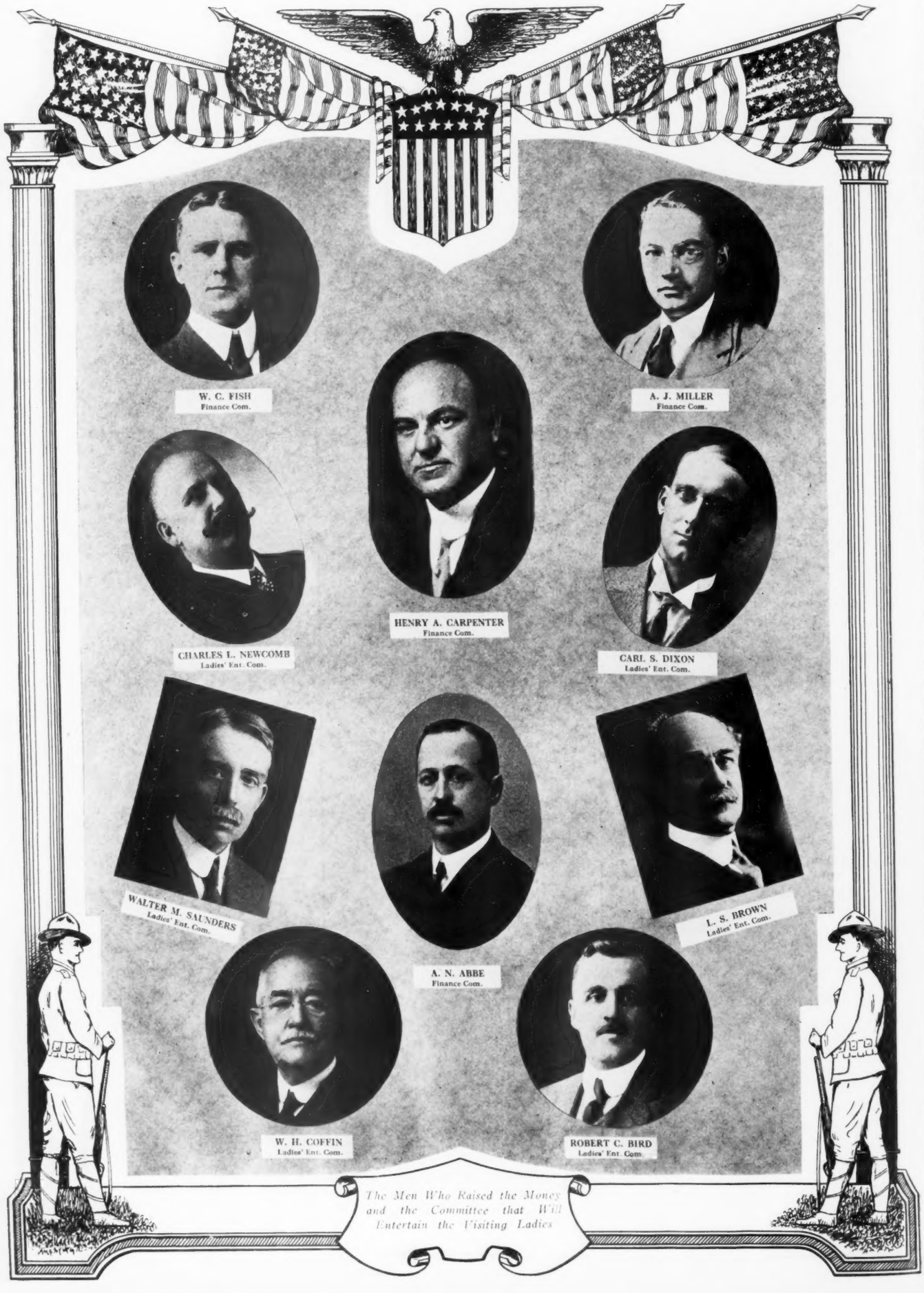
Friday, Sept. 28

9:30 A. M.—Professional session, American Institute of Metals, Hotel Somerset, for the discussion of metallurgy and metallography.

10:00 A. M.—Professional session, American Foundrymen's Association, Paul Revere hall, Mechanics' building; general topics.

10:00 A. M.—Steel session, American Foundrymen's Association, Mechanics' building.

Plant visitation.



The Men Who Raised the Money and the Committee that Will Entertain the Visiting Ladies

Program, American Foundrymen's Association

Monday, Sept. 24

10:00 A. M.—Registration, Mechanics' building.
1:00 P. M.—Opening of exhibition, Mechanics' building.
3:00 P. M.—Joint opening session, American Foundrymen's Association and American Institute of Metals, Paul Revere hall, Mechanics' building.

Address of welcome, by Hon. James M. Curley, mayor of the City of Boston.

Response to the address of welcome, by R. A. Bull, Duquesne Steel Foundry Co., Coraopolis, Pa.

Annual address by J. P. Pero, Missouri Malleable Iron Co., East St. Louis, Ill., president, American Foundrymen's Association.

Annual address by Jesse L. Jones, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., president, American Institute of Metals.

Report of the executive board of the American Foundrymen's Association.

Report of the secretary-treasurer of the American Foundrymen's Association, by A. O. Backert, Cleveland.

"Fire Prevention in Large Industrial Establishments," by C. W. Johnson, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Appointment of nominating committee and committee on resolutions.

Tuesday, Sept. 25, 10:00 A. M., Paul Revere Hall

"The Foundry From the Viewpoint of the Sales Engineer," by H. R. Atwater, Osborn Mfg. Co., Cleveland.

"The Relationship of the Engineering Department to the Pattern Shop and Foundry," by F. J. McGrail, Struthers-Wells Co., Warren, Pa.

"How Character Analysis Solves the Man Problem," by William Judson Kibby, Cleveland.

Report of A. F. A. committee advisory to the U. S. bureau of standards, by Richard Moldenke, chairman, Watchung, N. J.

"Efficiency in the Foundry," by James A. Fitzgerald, Reno, Pa.

"Co-Operative Shop Training," by W. B. Hunter, Fitchburg high school, Fitchburg, Mass.

1:30 P. M.—Boat ride in and about Boston harbor. Luncheon will be served on board.

Wednesday, Sept. 26, 10:00 A. M., Paul Revere Hall

"Improving the Relationship Between Employer and Employe," by J. F. Kent, American Cast Iron Pipe Co., Birmingham, Ala.

Report of A. F. A. committee on safety, sanitation and fire prevention, by Victor T. Noonan, chairman, Industrial Commission of Ohio, Columbus, O.

Report of A. F. A. committee on foundry costs, by B. D. Fuller, chairman, Westinghouse Electric & Mfg. Co., Cleveland.

Address on the cost work of the American Foundrymen's association, by C. E. Knoeppel, C. E. Knoeppel & Co., New York.

Report of A. F. A. representatives on the conference board on training of apprentices, by Frank M. Leavitt, chairman, University of Illinois, Chicago.

"The Labor Situation as Relating to Co-Operation Between the Employer and Employe," by G. E. Mac Ilwain, Babson's Statistical Organization, Wellesley, Mass.

"Micro-Metallography for the Foundry," by Robert J. Anderson, Cleveland Metal Products Co., Cleveland.

Report of nominating committee and election of directors.

Wednesday, Sept. 26, 10:00 A. M., Mechanics' Bldg.

Malleable Session

"The Theory of the Modern Waste-Heat Boiler and Possible Application of Such Boilers to the Malleable Melting Furnace," by A. D. Pratt, Babcock & Wilcox Co., New York.

"Application of Waste-Heat Boilers to the Malleable Melting Furnace," by C. D. Townsend, Danville Malleable Iron Co., Danville, Ill.

"Application of Pulverized Coal to the Air Furnace," by W. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

"The Application of Pulverized Coal to Malleable Melting Furnaces," by Joseph Harrington, Chicago.

"How Malleable Iron Has Improved," by Enrique Touceda, Albany, N. Y.

"Troubles Encountered in Machining Malleable Iron: Causes and Remedies," by A. T. Jeffery, Dayton Malleable Iron Co., Dayton, O.

"Comparative Carbon Losses in Malleable Iron Annealing by Muffle and Pot Oven Methods," by Joseph B. Deisher, T. H. Symington Co., Rochester, N. Y.

"The Effect of Iron Oxide in Molding Sand," by W. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

3:00 P. M.—Baseball game, Fenway Park, Boston and Cleveland American League teams.
8.15 P. M.—Theater party.

Thursday, Sept. 27, 10:00 A. M., Paul Revere Hall

Gray Iron Session

"Note on Fine Molding Sands," by C. P. Karr, U. S. bureau of standards, Washington, D. C.

Report of A. F. A. committee on general specifications for gray iron castings, by W. P. Putnam, chairman, Detroit Testing Laboratory, Detroit.

"Briquetting Foundry Borings," by A. L. Stillman, General Briquetting Co., New York.

"Cast Iron Shells in Permanent Molds," by Edgar Allen Custer, Philadelphia.

"The Seasoning of Gray Iron Castings," by L. M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R. I.

"Factors in the Economical Production of Small Cores in Large Quantities," by R. E. Kennedy, University of Illinois, Urbana, Ill.

"Modern Centrifugal Cupola Blowers," by J. W. Shugg, General Electric Co., Schenectady, N. Y.

"The Effect of High Sulphur in Gray Iron Castings," by T. Mauland, International Harvester Co., Chicago.

Thursday, Sept. 27, 10:00 A. M., Mechanics' Building

Steel Session

"Molding and Casting Large Slag Pots," by C. J. McMahon, Illinois Steel Co., Chicago.

"A Description of a Small Open-Hearth Furnace," by David McLain, McLain's System, Milwaukee.

"Small Steel Castings for Ordnance Purposes," by Major C. M. Wesson, Watertown Arsenal, Watertown, Mass.

"A New System of Burning Crude Oil," by W. A. Janssen, Davenport, Iowa.

"The Use of Vanadium in Steel Castings," by J. Lloyd Uhler, Union Steel Castings Co., Pittsburgh.

"Report of A. F. A. committee on steel foundry standards, by W. A. Janssen, chairman, Davenport, Ia.

12:00 M.—Luncheon for the ladies, followed by an automobile sightseeing tour.

12:30 P. M.—Visit to the West Lynn plant of the General Electric Co. Luncheon will be served at the works.

7:00 P .M.—Annual banquet, Copley-Plaza hotel.

Friday, Sept. 28, 10:00 A. M., Mechanics' Building

Steel Session

"Electric Furnace Design," by John A. Crowley, John A. Crowley Co., Detroit.

"Recent Developments in the Application of the Electric Furnace to the Melting Problem," by Douglas Walker, Booth-Hall Co., Chicago.

"Comparison of Electric Furnace and Steel Converter for the Manufacture of Small Steel Castings," by C. R. Messinger, Sivyer Steel Casting Co., Milwaukee.

"The Electric Furnace From the Central Station Standpoint," by E. L. Crosby, Detroit Edison Co., Detroit.

"The Electric Furnace in the Iron and Steel Foundry," by Max Trembour, Ludlum Steel Co., Watervliet, N. Y.

Friday, Sept. 28, 10:00 A. M., Paul Revere Hall

"Solution of Foundry Transportation and Conveying Problems," by Robert E. Newcomb, Deane Works, Worthington Pump & Machinery Corp., Holyoke, Mass.

"Sand-Blasting in the Foundry," by H. L. Wadsworth, American Foundry Equipment Co., Cleveland.

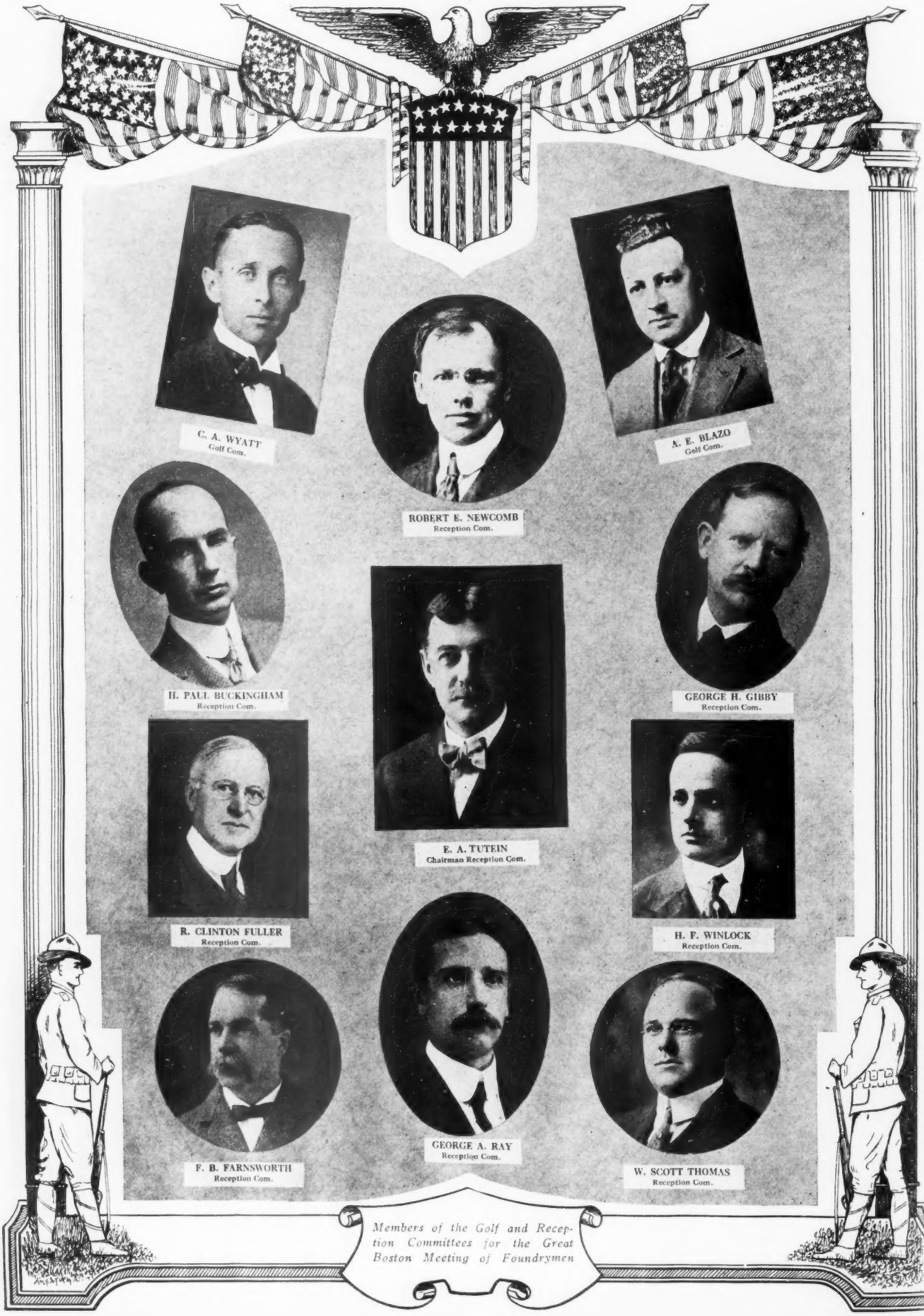
"Results of Tests in Blending and Mixing Sand by Means of Mullers," by R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston.

"Factors Contributing to the Economical Use of Grinding Wheels in the Foundry," by Wallace T. Montague, Norton Co., Worcester, Mass.

"Refractory Materials Employed in the Metallurgical Industries," by H. C. Arnold, University of Illinois, Urbana, Ill.

Installation of officers.

Plant visitation.



Members of the Golf and Reception Committees for the Great Boston Meeting of Foundrymen

300 carriage and wagon shops, the 800 machine tool builders, 100 manufacturers of electrical machines, etc. Another outlet for castings are the lathes, chucks, planers, shapers, drill presses, levels, planes, motors, sewing machines, meat choppers, printing presses, laundry machines, locks, typewriters, adding machines, engines, the number of foundries in each of the six states, it will be noted that there were 372 casting plants producing gray iron in New England in 1916. A careful study of the distribution of these foundries throughout the towns and villages of New England shows that the plants are widely scattered. There are few towns, villages, are small, is indicated by the thirteenth census report for Connecticut which shows that of the 403 establishments listed as "foundries and machine shops", 18 employed no wage earners, 116 employed from one to five, 85 from six to 20, 69 from 21 to 50, 40 from 51 to 100, 44 from 101 to 250, 16 from 251 to 500, eight

Program, American Institute of Metals

Monday, Sept. 24

10:00 A. M.—Registration, Mechanics' building.

3:00 P. M.—Joint opening session American Foundrymen's Association and American Institute of Metals, Paul Revere hall, Mechanics' building

Tuesday, Sept. 25, 9:30 A. M., Hotel Somerset

Melting and Casting Nonferrous Metals

"Raw Materials Used for Crucibles," by Prof. A. V. Bleininger, bureau of standards, Washington, D. C.

"Melting Yellow Brass in New Form of Induction Furnace," by G. H. Clamer, Ajax Metal Co., Philadelphia.

"Casting Bearings in Sand and Metal Molds," by R. R. Clarke, Pennsylvania Lines West of Pittsburgh, Pittsburgh.

"Negative Experiments on Waste Core Sand," by Dr. H. W. Gillett, bureau of mines, Ithaca, N. Y.

"The Crucible Situation," by M. McNaughton, Jos. Dixon Crucible Co., Jersey City, N. J.

"The Electric Furnace and Nonferrous Metals," by Dwight D. Miller, Society for Electrical Development, New York.

"My Experience with Metal Melting Furnaces," by W. H. Parry, National Meter Co., Brooklyn, N. Y.

"The Briquetting of Nonferrous Light Metal Scrap," by A. L. Stillman, General Briquetting Co., New York.

1:30 P. M.—Boat ride in and about Boston harbor. Luncheon will be served on board.

Wednesday Sept. 26, 9:30 A. M., Hotel Somerset

Uses of Nonferrous Metals for Munitions, Etc.

"The Present Status of Tin Fusible Plug Manufacture and Properties," by Dr. George K. Burgess, bureau of standards, Washington, D. C.

"Stellite," by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind.

"The Use of Die Castings in Munitions," by Chas. Pack, Doehler Die Casting Co., Brooklyn, N. Y.

"Shrapnel Bullets," by Harold J. Roast, Jas. Robertson Co., Ltd., Montreal, P. Q.

"A Few Points on Alloy Patents," by Wm. J. Rich, patent office, Washington, D. C.

Address by a representative of the United States tariff commission.

"The Use of Bronzes in Railroad Turntables and Movable Bridges," by O. E. Selby, Big Four railroad, Cincinnati.

"Recent Industrial Uses of Aluminum," by F. G. Shull, Aluminum Co. of America, Boston.

"The Consumption of Copper and Its Varied Uses," by H. D. Hawks, United Metals Selling Co., New York.

3:00 P. M.—Baseball game, Fenway park, Boston and Cleveland American League teams.

8:15 P. M.—Theater party.

Thursday, Sept. 27, 9:30 A. M., Hotel Somerset

Testing of Nonferrous Metals

"Comparative Tests on Test Bars and Actual Castings," by W. M. Corse, Titanium Bronze Co., Niagara Falls, N. Y.

"Analysis of Babbitts and Brasses," by E. W. Hagmaier, Buffalo.

"Standard Test Bars of 88-10-2 and 88-8-4, being the result of co-operative work of six foundries; a new series of tests," by C. P. Karr, bureau of standards, Washington, D. C.

"The Expansion Coefficients of Alpha and Beta Brass" and "The Corrosion of Manganese Bronze Under Stress," by Dr. Paul D. Merica, bureau of standards, Washington, D. C.

"Corrosion of Brasses of the Muntz Metal Type," by H. S. Rawdon, bureau of standards, Washington, D. C.

Address by Richard C. Maclaurin, president, League to Enforce Peace.

"The School End of the Job in Training Foundrymen," by Dean C. B. Connelley, Carnegie Institute of Technology, Pittsburgh.

"The Flux and Cleaner Question of Brass," by E. D. Frohman, S. Obermayer Co., Pittsburgh.

"Pyrometers—Their Construction and Application," by John P. Goheen, Brown Instrument Co., Philadelphia.

"Electrically-Heated Core Ovens," by Dr. C. F. Hirshfeld, Edison Illuminating Co., Detroit.

"Brass Rolling Mill Alloys," by Roy A. Wood, Cheshire, Conn.

12:00 M.—Luncheon for the ladies, followed by an automobile sightseeing tour.

12:30 P. M.—Visit to the West Lynn plant of the General Electric Co. Luncheon will be served at the works.

7:00 P. M.—Annual banquet, Copley-Plaza hotel.

Friday, Sept. 28, 9:30 A. M., Hotel Somerset

Metallurgy and Metallography

"The Electrolytic Production of Antimony," by Prof. D. J. Demorest, Ohio State University, Columbus, O.

"The Electrical Properties of Some High Resistance Alloys," by Prof. M. A. Hunter, Rensselaer Polytechnic Institute, and F. M. Sebast, Troy, N. Y.

"The Amorphous Theory in Metals," by Zay Jeffries, Aluminum Castings Co., Cleveland.

"The Volatility of Zinc and Cadmium," by John Johnston and Edward Schramm, American Zinc, Lead & Smelting Co., St. Louis.

"Surface Tension and Deoxidizing of Metals," by W. J. Knox, Metals Deoxidizing & Refining Co., New York.

"Antimony—Its Metallurgy and Uses," by K. C. Li, Wah Chang Mining & Smelting Co., Inc., New York.

"Development and Reabsorption of the Beta Constituent in Alloys which are Normally of the Alpha Type," by Prof. C. H. Mathewson, department of mining and metallurgy, Yale University, and Philip Davidson, New Haven, Conn.

"The Swelling of Zinc Base Die Castings," by H. M. Williams, National Cash Register Co., Dayton, O.

Plant visitation.

marine motors, propellers, gun mounts and carriages, etc., which are turned out by the thousands in New England's many shops. The foundry industry supplements other lines of manufacturing, and is indispensable to the future development of the district. Referring to Table II, which shows even the smallest villages, which do not boast of a foundry. In size, the castings shops vary from those which melt a few tons at irregular periods to the larger ones which melt upwards of 150 tons daily. That a large percentage of the foundries, especially those in outlying towns and from 501 to 1000, and seven over 1000 employes. In other words, about 50 per cent of the plants employ less than 20 men.

The larger gray iron foundries are in many cases departments of extensive manufacturing plants. This is especially true of the foundries making

The Committee that Will See to It that the Visiting Foundrymen Are Well Entertained

Members, New England Convention Committees

Executive Committee

W. J. Lavelle, chairman, New England Coal & Coke Co., Everett, Mass.
J. O. Henshaw, 79 Milk street, Boston.
C. A. Reed, Reed, Fears & Miller, Boston.
R. D. Walker, Walker & Pratt Mfg. Co., Boston.
W. E. Freeland, *The Iron Age*, Worcester, Mass.
A. R. Plant, Blackstone National bank, Providence, R. I.
W. A. Viall, Brown & Sharpe Mfg. Co., Providence, R. I.
Fred F. Stockwell, Barbour-Stockwell Co., Cambridge, Mass.
A. B. Root Jr., Hunt-Spiller Mfg. Corp., Boston.
T. R. Scott, Brown & Sharpe Mfg. Co., Providence, R. I.

Reception Committee

E. A. Tutein, chairman, 53 State street, Boston.
H. Paul Buckingham, Arcade Malleable Iron Co., Worcester, Mass.
H. E. Winlock, Barbour-Stockwell Co., Cambridge, Mass.
George H. Gibby, Gibby Foundry Co., E. Boston, Mass.
W. Scott Thomas, J. W. Paxson Co., Providence, R. I.
F. B. Farnsworth, McLagon Foundry Co., New Haven, Conn.
George A. Ray, Taylor & Fenn Co., Hartford, Conn.
H. W. Woodworth, American Tool & Machine Co., Boston.
Charles Van Stone, Lumsden & Van Stone Co., South Boston, Mass.
D. D. Barlett, Builders Iron Foundry, Providence, R. I.
F. W. Stickle, Capitol Foundry Co., Hartford, Conn.
Robt. E. Newcomb, Deane Steam Pump Works, Holyoke, Mass.
R. C. Fuller, Fuller Iron Works, Providence, R. I.

Finance Committee

W. A. Viall, chairman, Brown & Sharpe Mfg. Co., Providence, R. I.
H. A. Carpenter, General Fire Extinguisher Co., Providence, R. I.
W. J. Breen, Wm. J. Breen Co., Boston.
A. N. Abbe, American Hardware Corp., New Britain, Conn.
A. R. Plant, Blackstone National Bank, Providence, R. I.
A. J. Miller, Whitehead Bros. Co., Providence, R. I.
W. C. Fish, General Electric Co., Lynn, Mass.
L. G. Kibbe, Turner & Seymour Mfg. Co., Torrington, Conn.

Ladies Entertainment Committee

R. D. Walker, chairman, Walker & Pratt Mfg. Co., Boston.
L. S. Brown, Springfield Facing Co., Springfield, Mass.
Charles L. Newcomb, Deane Steam Pump Works, Holyoke, Mass.
Robert C. Bird, Broadway Iron Foundry, Cambridge, Mass.
Carl S. Dixon, General Electric Co., Pittsfield, Mass.
W. H. Coffin, Springfield Facing Co., Springfield, Mass.
J. F. Lanigan, Davis Foundry Co., Lawrence, Mass.
W. M. Saunders, Saunders & Franklin, Providence, R. I.

Entertainment Committee

C. A. Reed, chairman, Reed, Fears & Miller, Boston.
W. T. Bennett, secretary, Griffin Wheel Co., Chelsea, Mass.
S. E. French, Athol Machine Works, Athol, Mass.
T. Officer, Sullivan Machinery Co., Claremont, N. H.
A. F. Corbin, Union Mfg. Co., New Britain, Conn.
H. A. Nealley, Jos. Dixon Crucible Co., Boston.
G. P. Aborn, Blake & Knowles Steam Pump Works, Cambridge, Massachusetts.
C. A. Olson, Walworth Mfg. Co., Boston.
B. S. Leslie, United Shoe Machinery Co., Beverly, Mass.
T. R. Scott, Brown & Sharpe Mfg. Co., Providence, R. I.
Chas. V. S. Paul, R. Estabrook's Sons, Boston.
Charles L. Nutter, Old Colony Foundry, Bridgewater, Mass.
C. E. Hildreth, Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.
E. B. Freeman, B. F. Sturtevant Co., Hyde Park, Mass.
D. F. Eagan, Hotel Seymour, Lynn, Mass.
T. I. Curtis, Waltham Foundry Co., Waltham, Mass.
A. L. Haasis, Jos. Dixon Crucible Co., Jersey City, N. J.

Golf Committee

J. O. Henshaw, chairman, 79 Milk street, Boston.
R. E. Blazo, Rogers, Brown & Co., Boston.
C. A. Wyatt, Debevoise-Anderson Co., Boston.
Thomas F. Stokes, Alley & Page Co., Boston.

Press Committee

W. E. Freeland, chairman, *The Iron Age*, Worcester, Mass.
A. W. Howland, New York.
A. O. Backert, Cleveland.

castings for textile and electrical machinery and machine tools. A number of the gray iron jobbing foundries have developed comparatively large volumes of business, one concern of this kind in southern New England having a capacity of about 150 tons daily. Manufacturing stoves is an important branch of the gray iron foundry industry in New England. According to late figures there are about 20 stove foundries in this section, half of this number being in the state of Massachusetts. A description of one of the leading plants appears elsewhere in this issue of THE FOUNDRY.

Table II shows that there are 347 foundries in New England casting brass and 229 melting aluminum. Brass is melted exclusively in 188 of these foundries, and in the remaining 159, brass is only one of two or more metals cast. The growth of the brass foundry industry in Massachusetts and Connecticut has been stimulated by the success of hardware manufacture in these states and by the demand for brass castings for machinery. It is not surprising that 104 brass foundries are in Connecticut, for almost nine-tenths of the rolled brass products manufactured in the United States are made in that state. While many of the brass foundries are identified with concerns primarily engaged in the rolled brass industry, the product of a large number of the casting plants finds its way into builders' hardware, machine bearings, valves and fittings,

Table I

FOUNDRIES IN NEW ENGLAND, 1894 TO 1917

	1894	1900	1904	1906	1908	1910	1912	1914	1916	1917
Connecticut	112	103	187	156	158	169	170	167	169	176
Maine	48	47	57	48	48	48	49	45	43	44
Massachusetts	176	167	272	247	264	276	282	282	273	294
New Hampshire	34	36	41	38	36	37	37	36	37	38
Rhode Island	29	30	54	48	41	41	40	42	41	43
Vermont	24	34	35	31	32	31	28	28	25	25
Total New England	423	417	646	568	579	602	606	600	588	622

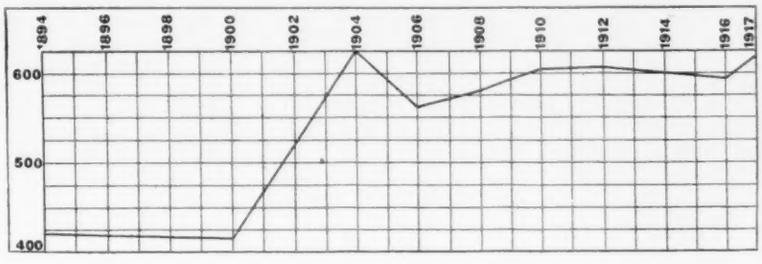


CHART SHOWING THE INCREASE IN THE NUMBER OF FOUNDRIES IN NEW ENGLAND SINCE 1894.

Data for years 1894 to 1916, inclusive, compiled from *Penton's Foundry List*. Number of foundries in 1917 estimated.

plumbers' goods, etc. According to *Penton's Foundry List*, there were 18 malleable iron foundries in New England in 1916. Without exception, the 11 malleable plants in Connecticut are situated in the southwestern part of the state, and most of them are in the Naugatuck valley. Four of the largest malleable casting plants are controlled by a single company, which operates similar plants in other eastern states. The product of the Connecticut malleable foundries is used in hardware specialties; fittings for gas, steam and water lines; laundry machinery; railway car castings, etc. Two of the four malleable plants of Massachusetts are in Boston, and there is one malleable foundry in Rhode Island and one in New Hampshire.

Table II

FOUNDRIES IN NEW ENGLAND COMPARED WITH FOUNDRIES IN UNITED STATES IN 1916

	Total	Gray iron	Exclusive brass	Brass, departments of other shops	Total brass	Malleable	Steel	Melting aluminum
Connecticut	169	88	69	35	104	11	2	66
Maine	43	36	7	26	33	..	..	17
Massachusetts	273	172	88	55	143	4	13	102
New Hampshire	37	29	7	16	23	2	..	18
Rhode Island	41	24	15	10	25	1	1	17
Vermont	25	23	2	17	19	..	..	9
Total New England	588	372	188	159	347	18	16	229
Total United States	5741	4267	1160	1979	3139	197	304	2121
Per cent	10.24	8.70	10.17	8.03	11.05	9.13	5.26	10.79

Data compiled from *Penton's Foundry List*.

Manufacturing steel castings was not attempted in New England until long after the other branches of the foundry industry had been firmly established. New Hampshire, Vermont, Massachusetts and Connecticut were making steel castings in 1880 and Massachusetts, Rhode Island and Connecticut were producing converter steel castings in the early part of the present century. One manufacturer of electrical machinery was operating three basic open-hearth furnaces in 1905 with a daily capacity of 45 tons. A foundry and machine company in that year had a crucible plant of 100 pots with a capacity of 4 tons daily. A Connecticut steel foundry was then producing 3½ tons per day. In 1916 there were two steel casting plants in Connecticut, 13 in Massachusetts and one in Rhode Island. Of the total number in New England, about one-half are operated as departments of manufacturing companies which use steel castings in their primary products. The others are departments of jobbing foundries, some of which are equipped to cast brass, gray iron, malleable iron and steel. The jobbing steel foundry, producing steel castings exclusively, has not gained the foothold in New England that it has in the middle west, where it owes its prosperity to the automobile industry.

The electric steel industry is comparatively new in New England, and promises to become firmly established in a few years. The first electric furnace in this part of the country was installed by a tool and hardware manufacturer to make castings for his own use. Strangely enough, the first jobbing electric steel foundry, completed a few months ago in Hartford, more nearly approaches the type of plant adopted in Pennsylvania, Ohio and Illinois than any other foundry in New England. Whereas most of the foundries in the east are of mill construction, employing wood almost exclusively, this electric steel plant is constructed of sheet metal on steel framework, steel sash providing unusually large window areas. A 2-ton heroult furnace is now in operation and another will be installed as soon as the buildings now about to be erected are completed. The Connecticut Electric Steel Co., which operates this plant, designed it for making small castings, but quickly engaged in making gun mounts for the United States navy and castings for anti-aircraft truck mounts for the army. Thus New England's first electric steel foundry has entered a field of extreme usefulness in assisting the government to wage war.

New England foundries are assuming their fair share in producing castings for the government's war needs. The manufacture of ships, gun mounts, ammunition, wire goods, stoves and other cantonment equipment is imposing a demand for castings to which the foundries are nobly responding. In many casting plants a large proportion, and in a few all of the capacity is engaged in government work.

The mid-year period of 1917 finds the foundry industry in an unusually prosperous condition. According to various sources of information, it is estimated that there are now 622 casting plants operating in New England.

What You Will See at the Boston Exhibition

ABELL-HOWE CO., Chicago.—A one-man detachable tongue truck in two or three types, indicative of the manner in which this truck accommodates itself to the handling of various materials, will be exhibited. High speed chain also will be shown, suitable for the driving of blowers, machine tools or for the general transmission of power in foundries and machine shops. A display also will be made of electric hoists; represented by Oliver J. Abell.

AJAX METAL CO., Philadelphia.—In addition to having its space fitted up as a reception room for visiting foundrymen, this company will exhibit its line of ingot metals together with a variety of castings made from them; represented by Frank M. Willeson, G. H. Clamer, Chas. F. Hopkins, Jos. C. Brightbill, and J. Millson Graham.

ALBANY SAND & SUPPLY CO., Albany, N. Y.—A stove built by the Walker-Pratt Mfg. Co., Boston, all the parts of which were cast in Albany sand furnished by the Albany Sand & Supply Co., will be exhibited. In addition this space will be fitted up as a rest room for the many friends of this concern; represented by Lawrence Murray and Chas. H. Bird.

AMERICAN FOUNDRY EQUIPMENT CO., New York.—This exhibit will consist of a sand cutting machine; rotary table sand-blast room; humane sand-blast rotary table in which the operator stands outside and is immune from dust; a large sand-blast tumbling barrel and a new type of humane sand-blast room for handling all kinds of small work; represented by V. E. Minich, H. L. Wadsworth, Hutton H. Haley, J. D. Alexander and Charles G. Smith.

AMERICAN GUM PRODUCTS CO., New York.—The core binder manufactured by this company will be exhibited; represented by Gordon I. Lindsay.

AMERICAN LIGHTING CO., Chicago.—Industrial and railroad flood lights will be exhibited, these units using 750 or 1000-watt standard lights with a glass reflector, highly silvered and polished. These lights are used extensively in foundry operations where night work is carried on; represented by W. J. Davis Jr., F. M. Evans and J. C. Starr.

AMERICAN MOLDING MACHINE CO., Terre Haute, Ind.—A 10-inch jolt-ramming rock-over molding machine, provided with a table 30 x 40 inches, will be shown in operation, as well as a jolt-ramming stripping plate machine with a 12-inch draw and a 24 x 36-inch table; represented by W. C. Norcross and L. J. Cox.

AMERICAN PIPE BENDING MACHINE CO., Boston. — The pipe bending machine built by this company will be shown in operation; represented by Mark Angel, James Heggie, John Heggie and E. P. Blake.

ARCADE MFG. CO., Freeport, Ill.—The line of molding machines to be exhibited by this company will include a 24-inch electrically-operated, roll-over jolt-ramming and pattern-drawing machine; two sizes of jolt-ramming machines, one showing a ferrule plate; piston cope and drag machines; a combined jolt-ramming and squeezer machine; air and hand squeezer machines; midget core jolt-ramming machine; 17½-inch jar-ramming machine and a pouring device; represented

by E. H. Morgan, Chas. Morgan, L. L. Munn, R. E. Turnbull, Henry Tscherning, August Christen and G. D. Wolfley.

ARMSTRONG CORK CO., Pittsburgh.—Insulating brick for furnaces, ovens, boiler settings, etc., high pressure covering for steam lines, corkboard insulation for cold storage rooms, cork covering for drinking water systems for mills and factories and cork machinery isolation for deadening the noise of machines, will be displayed. In addition, an electrically-heated furnace will be shown in operation for demonstrating the non-conducting properties of insulating brick.

ATHOL MACHINE CO., Athol, Mass.—Vises of many types and an extensive assortment of mechanics' tools will be displayed. Photographs of the company's plant also will be shown, illustrating the play-grounds, baseball and basket ball fields, club house and safety devices in the company's shops; represented by Stephen E. French and H. K. Parkman.

ATKINS, E. C., & CO., Indianapolis, Ind.—An extensive display will be made of saws of all kinds, including metal-cutting circular saws, hack saw blades, frames, hand saws, metal-cutting machines and foundry plates; represented by T. H. Endicott, W. L. Timpone, Geo. W. Steenberg and Thos. A. Carroll.

AYER & LORD TIE CO., Chicago.—The interior creosoted wood blocks manufactured by this company will be installed in the floor of its booth and photographs and other data, descriptive of this type of material will be shown; represented by A. Y. Noyes, W. H. Blythe, B. S. McConnell, F. W. Decker, R. H. and R. G. Inslee and H. G. Stephens.

B. & B. MFG. CO., Indianapolis.—Several types of the molding machines made by this company will be shown and both power and hand squeezers of the portable and stationary types will be demonstrated.

BEAUDRY & CO., INC., Boston.—A 100-pound power hammer arranged for motor drive and a similar power hammer of 50 pounds capacity, built by the United Hammer Co., Boston, will be displayed; represented by O. H. Abramson and A. Parsons.

BERKSHIRE MFG. CO., Cleveland. — An air squeezer, equipped with a vibrator and a lifting device will be displayed. In addition a complete line of aluminum, wood and iron flasks and special aluminum match-plates will be exhibited; represented by R. H. York, W. A. Price, G. L. Cannon and W. D. Fraser.

BESLY, CHARLES H., & CO., Chicago.—An operating exhibit, consisting of the following machines will be made: A 53-inch vertical spindle disc grinder, 24-inch wide faced ring wheel grinder with 30-inch disc wheel for finish grinding, 20-inch double spindle disc grinder and a 30-inch pattern-makers' disc grinder; represented by Edward P. Wells, Charles A. Knill, Ralph W. Young and J. F. Curns.

BIRKENSTEIN, S., & SONS, Chicago.—A complete line of non-ferrous metals and alloys will be exhibited, including ingot brass, ingot bronze, ingot copper, pig tin, pig lead, solder, babbitt, phosphor-copper, phosphor-tin, manganese bronze, etc. Castings made from these ingots also will be displayed.

BLODGETT, G. S., CO., Burlington, Vt.—Two or three samples of the core-baking ovens manufactured by this company will be exhibited; represented by R. L. Patrick.

BLYSTONE MFG. CO., Cambridge Springs, Pa.—A core sand mixer with screen, motor and power discharge attached will be exhibited; represented by Luther G. Conroe and T. A. Graham.

BRIDGEPORT SAFETY EMERY WHEEL CO., Bridgeport, Conn.—Belt and motor-driven grinding and polishing machinery, together with a number of grinding wheels will be exhibited. A portion of this machinery display will be operated; represented by D. T. Homan.

BROWN SPECIALTY MACHINERY CO., Chicago.—Two styles of core machines, one of which will be operated, and an electric duplex shaker will be shown, in addition to a revolving barrel sand-blast machine equipped with cloth screen type dust arrester and exhaust fan, which will be in operation; represented by Elmer A. Rich Jr., J. E. Sweet, R. E. Laycock, J. L. Laycock and R. G. Coburn.

BUCKEYE PRODUCTS CO., Cincinnati.—Metal melting crucible and non-crucible furnaces will be exhibited as well as air and electric vibrators, parting and core compounds, fluxes, etc.; represented by C. J. Goehringer, D. S. Marfield, B. Bernbaum, C. Gysin, J. B. Carpenter and E. R. Sutton.

CARBORUNDUM CO., Niagara Falls, N. Y.—Carborundum and aloxite wheels, special carborundum wheels for malleable grinding and samples of crude material from which these wheels are made will be shown. The booth of this company also will be fitted up as a rest and reception room for visitors; represented by C. E. Hawke, J. E. Rayner, John MacArthur, H. E. Hammond, G. E. Dresser, O. C. Dobson and H. E. Kerwin.

CATARACT REFINING & MFG. CO., Buffalo.—Core oils, parting compounds, cutting oils and quenching and tempering oils will be exhibited; represented by J. Purvis, A. A. Schaefer, F. F. Hennessy, J. A. MacVeagh, M. E. Becker and F. N. Tweedy.

CHAMPION FOUNDRY & MACHINE CO., Chicago.—An operating exhibit consisting of two electric sand riddles will be made; represented by T. J. and H. O. Magnuson.

CHASE, FRANK D., Chicago. — Photographs of foundries and other industrial plants built by this engineering firm will be displayed; represented by Frank D. Chase and F. H. Sprague.

CHASE TURBINE MFG. CO., Orange, Mass.—A joint exhibit with the Divine Bros. Co., Utica, N. Y., will be made. The Chase company will display a new automatic polishing and buffing machine and Divine Bros. will show compressed polishing wheels, wheel dressers, balancers, etc.; represented by W. G. Chapman, B. H. Divine and F. W. Sturdevant.

CHICAGO PNEUMATIC TOOL CO., Chicago.—Pneumatic chipping hammers, rammers, hoists, compressors, drills, etc., will be shown.

CHISHOLM-MOORE MFG. CO., Cleveland.—Several types of hoists manufactured by this company will be displayed and an aluminum miniature model hoist will be exhibited showing the inside mechanism.

CINCINNATI PULLEY MACHINERY CO., Cincinnati. — Nine motor-driven, ball-bearing drilling machines of different types and speeds, adapted to the varying conditions of machine shop work will be displayed; represented by J. G. Hey, J. F. Merrieless and C. K. Cairns.

CLARK, CHARLES J., Chicago. — Meters employed for measuring the quantity of blast supplied to cupolas will be displayed and several new instruments also will be shown, which will prove of interest to those now using blast volume meters; represented by Charles J. Clark.

CLEVELAND BLOW PIPE & MFG. CO., Cleveland.—This exhibit will consist of a motor-driven exhaust fan, various designs of hoods for use on buffing, polishing and emery wheels, dust collector and the necessary material required to connect from the emery wheels to the exhaust fan and from the exhaust fan to the dust collector. The fan is used to create a vacuum from the hoods through the necessary pipe and elbows, discharging into the dust collector which removes the dust from the air by centrifugal force. A two-section shower bath for foundry and factory use also will be displayed. Photographs will be exhibited showing sheet metal specialties made by this company for factory use; represented by Edward Coney.

CLEVELAND MILLING MACHINE CO., Cleveland.—A cutter relieving machine, profile grinder, milling machine and a horizontal boring mill will be shown in operation; represented by L. H. Mesker.

CLEVELAND PNEUMATIC TOOL CO., Cleveland.—A complete line of air-operated tools for foundry purposes will be shown in operation. This will include pneumatic tools in all sizes for machine shop work, such as riveting hammers, chipping hammers, etc., sand rammers for foundry use as well as air drills, portable casting grinders, air hose, hose couplings, etc.; represented by H. S. Covey, Arthur Scott, Chas. Garner, G. Gregory and F. E. Schwarze.

COALE, THOMAS E., LUMBER CO., Philadelphia. — A remarkable assortment of white pine and sugar pine pattern lumber in several thicknesses, will be displayed; represented by Thos. E. Coale.

COMBINED SUPPLY & EQUIPMENT CO., Buffalo.—Foundry supplies will be exhibited.

CURTIS PNEUMATIC MACHINERY CO., St. Louis.—The entire exhibit to be made by this company will be operated and will include a vertical double-cylinder single-acting compressor, water-cooled, with a regulating sight feed splash oiling attachment. This compressor will be motor-driven with automatic pressure control and is provided with a circulating pump for cooling water. Hoists and trolleys also will form a part of this display. Pendant vertical cylinder air hoists will be shown as well as a horizontal rope compounded cylinder air hoist, suspended from single I-beam trolleys. Single I-beam hand-operated bridge crane with trolley and a single I-beam bracket jib crane also will be shown; represented by Joseph Macksey.

CUTTER & WOOD SUPPLY CO., Boston.—The large space to be occupied by this company will include the displays of the Chisholm-Moore Mfg. Co., Cleveland, and the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. The Cutter & Wood Supply Co. is the Boston representative of both of these concerns. In addition to the Chisholm-Moore Mfg. Co., the Shepard Electric Crane & Hoist Co., exhibits, an extensive line of tools and supplies employed in metal casting, cleaning, machining, finishing, electro-galvanizing and plating will be displayed; represented by W. S. Wood and Wm. H. Mulholland.

DAILY IRON TRADE AND METAL MARKET REPORT, Cleveland. — This booth will be fitted up as a rest room for visiting foundrymen and free stenographic service will be provided for the exhibitors and visitors; represented by John A. Penton, A. O. Backert, C. J. Stark, H. Cole Estep, J. D. Pease, F. V. Cole, S. H. Jasper, G. O. Hayes, J. F. Ahrens, E. L. Shaner and A. J. Mueller.

DAVIS-BOURNONVILLE CO., Jersey City, N. J.—Oxyacetylene and oxyhydrogen welding and cutting apparatus, acetylene pressure generators, portable outfits, special cutting machines and accessories will be displayed; represented by F. C. Whitney, M. S. Plumley, H. H. Dyar, W. W. Barnes, Alex. Blazer, Geo. Jaeger, G. J. Strobel, F. A. Blood, F. C. Hobbs and G. V. Greene.

DEBEVOISE - ANDERSON CO., INC., New York.—The various brands of bee-hive oven and by-product cokes sold by this company will be displayed, as well as different grades of pig iron, 50 per cent ferrosilicon, limestone and coal; represented by W. Anderson.

DINGS MAGNETIC SEPARATOR CO., Milwaukee.—Four types of power-driven separators will be shown in operation. One of

these machines will have a motor attached, another will be provided with a motor generator set, a third will be of the magnetic pulley type with motor and the fourth will be a hand magnet; represented by Messrs. Fobian and Bethke.

DIXON, JOSEPH, CRUCIBLE CO., Jersey City, N. J.—Crucibles, covers, stirrers, stoppers, sand crucibles, scorifiers, cupels, etc., will be displayed; represented by C. A. Johnson, H. C. Sorenson, J. J. Belleville, J. J. Tucker, R. H. Brinkerhoff, C. A. Shaw, E. A. St. John, A. L. Hassis, R. F. Leonard, J. K. Mosen, John A. Condit and H. A. Nealley.

DROUVE, G., Co., Bridgeport, Conn.—An extensive display will be made of samples of puttyless skylight and numerous blueprints and photographs will be shown, illustrating the applications of the sash manufactured by this company.

EASTERN BRASS & INGOT CORP., Waterbury, Conn.—Brass briquette ingots made from various classes of brass chips, brass turnings, etc., will be displayed. The service afforded by this company to producers and consumers of scrap metals consists of converting these finer forms of brass scraps into briquette ingots which are sufficiently solid to withstand commercial handling; represented by Howard Baker, Fred A. Purdy, George G. Hanson and W. S. Lord.

FEDERAL FOUNDRY SUPPLY CO., Cleveland.—An extensive display of molding machines will be made by this company, which will include six different sizes of jolt-ramming machines constructed without valves. When the piston opens the exhaust it automatically shuts-off the intake and the expansion of the air forces the piston the remainder of its travel until the exhaust is fully opened, when the piston drops to the starting point. Six different types of power squeezers and combination jolt and squeezer machines also will be displayed. Extra long cylinders are provided on all squeezers which have extra heavy leather pistons, thereby eliminating the loss of air and effecting economies in air consumption. The plain power squeezers will be shown in two sizes with cylinders 9 and 12 inches in diameter, respectively. Two sizes of the combination jolt-ramming and squeezer machines also will be shown, one having a 9-inch squeezing cylinder and a 4-inch jolting cylinder and the other, a 12-inch squeezing cylinder and 5-inch jolting cylinder. These machines are built both stationary and portable. Four sizes of electric vibrators and knee switches, portable and stationary core ovens provided with swinging doors, also will be shown, as well as samples of plumbago, parting compound, steel cement, wax vent wire, etc., represented by Ralph Ditty, Walter J. Adams, I. D. Adams, Ellsworth Kaye, W. J. Smith and John Bayer.

FELT & TARRANT MFG. CO., Chicago.—The adding and calculating machines manufactured by this company will be displayed and demonstrations in their application to inventory, payroll, cost work, billing, etc., will be made; represented by William F. Sims.

FORBES & MYERS, Worcester, Mass.—Polishing and buffing machines will be displayed.

FOREIGN CRUCIBLES CORP., LTD., New York.—Samples of the imported graphite crucibles sold by this company will be shown; represented by Geo. H. Ames.

FOUNDRY EQUIPMENT CO., Cleveland.—Core and mold ovens, core cars, melting furnaces, oil burners, etc., will be displayed; represented by F. A. Coleman and C. A. Barnett.

THE FOUNDRY, Cleveland.—This booth will be fitted up as a rest room for visiting foundrymen and free stenographic service will be provided for the exhibitors and visitors; represented by John A. Penton, A. O. Backert, C. J. Stark, H. Cole Estep, J. D. Pease, F. V. Cole, S. H. Jasper, G. O. Hayes, J. F. Ahrens, E. L. Shaner, and A. J. Mueller.

GARDNER MACHINE CO., Beloit, Wis.—Belt and motor-driven disc grinders, as well as samples of work done on disc-grinding machines will be exhibited.

GENERAL ELECTRIC CO., Schenectady, N. Y.—One of the features of this exhibit will be an electrically-operated core oven furnished by the Oven Equipment Co., New Haven, Conn. It will be equipped with six General Electric heating units operating at a maximum capacity of 21 kilowatts, and arranged for service on a 220-volt, 60-cycle, 3-phase, alternating current circuit. The other equipment includes a control panel, a mercury-actuated thermostat and a recording thermometer. The oven will be heated to an average of 350 to 500 degrees Fahr. In addition, a centrifugal air compressor for furnishing blast to cupolas will be displayed. These compressors now are widely used and are particularly adapted for cupola service because of the non-pulsating character of the blast, with motor or turbine drive. Operating with a direct current motor the drive pressure is regulated by changing the speed of the set by motor field rheostat. For induction motors arranged for constant speed and pressure, the blast is regulated in place of the motor; represented by J. M. Hollister, M. R. Griffith, A. R. Bush, W. C. Fish, C. B. Davis, J. F. Steele and D. G. Brokaw.

GENERAL FIRE EXTINGUISHER CO., Providence, R. I.—The automatic sprinkler system built by this company will be installed in a wire-glass house for the purpose of demonstrating its methods of operation and that of the American District Telegraph supervisory system. Motion pictures also will be shown several times daily featuring the operation of this system and the Grinnell automatic sprinkler head which forms an important part of it. A method of gas heating for domestic and industrial purposes also will be demonstrated; represented by W. A. Kennedy, A. J. Richmond, R. A. Jenckes, J. D. Pryor, George S. Barrows and Carl Hausler Hale.

GOLDSCHMIDT THERMIT CO., New York.—A large weld on a crank shaft made by the thermit process will be exhibited, as well as a complete line of samples of all of the carbon-free metals and alloys made by this company including tungsten, chromium-manganese, ferro - chromium, ferro - tungsten, manganese-copper, cobalt, etc.; represented by Arthur F. Braid, H. G. Spilsbury, J. G. McCarty, W. R. Hulbert and H. D. Kelley.

GREAT WESTERN MFG. CO., Leavenworth, Kans.—Three types of gyratory foundry riddles, as well as a new riddle designed for bench work will be shown; represented by F. A. Pickett and George W. Combs.

HARRISON SUPPLY CO., Boston.—Metallic sand-blast abrasives will be exhibited, including chilled shot and crushed shot for sand-blast purposes; represented by Nathan C. Harrison, J. Henry Duclos Jr., Charles R. Dawson, B. L. Snow and E. E. Ricker.

HAUCK MFG. CO., Brooklyn, N. Y.—Cupola lighters, mold dryers, ladle and rivet heaters, torches and forges will be exhibited; represented by A. E. Hauck, Busch Hauck and A. P. Link.

HAYWARD CO., New York.—Photographs of the equipment built by this company for handling various materials with different kinds of hoisting apparatus will be exhibited; represented by H. M. Davison and C. F. Hutchings.

HERMAN PNEUMATIC MACHINE CO., Pittsburgh.—A plain jar-ramming molding machine and a combination jar-ramming and squeezer machine will be exhibited, but will not be operated; represented by Thos. Kaveny, H. T. Frauenheim, A. M. Frauenheim, Alfred Herman, Robt. F. Ringle, I. J. Oesterling, R. P. Morgan, Walter Hughes, A. McWithey, Robt. Porteous and Harry W. Gahan.

HILL, CLARKE & CO., Boston.—The extensive display of machine tools to be made by this company will be operated.

HOEVEL MFG. CORP., New York.—A rotary table sand-blast machine and a revolving barrel sand-blast machine, built by this company, will be shown in operation; represented by H. F. Hoevel, F. W. Weiss, L. E. Passmore and G. H. Seltzer.

HOLZ, HERMAN A., New York City.—A portable apparatus for determining the hardness of metals will be shown.

INTERNATIONAL MOLDING MACHINE CO., Chicago.—Electric and air jar-ramming molding machines, power squeezers, combination jolt squeezers, combination stripping squeezers, hand turn-over pattern-drawing machines, power turn-over power pattern-drawing machines, combination jar-ramming machines of the turn-over pattern drawing, power turn-over foot pattern-drawing and power turn-over power pattern-drawing types, as well as stripping plate machines will be exhibited; represented by Edward A. Pridmore, W. W. Miller, F. W. Hamel and J. L. Lanigan.

THE IRON TRADE REVIEW, Cleveland.—This booth will be fitted up as a rest room for visiting foundrymen and free stenographic service will be provided for the exhibitors and visitors; represented by John A. Penton, A. O. Backert, C. J. Stark, H. Cole Estep, J. D. Pease, F. V. Cole, S. H. Jasper, G. O Hayes, J. F. Ahrens, E. L. Shaner and A. J. Mueller.

JENNISON-WRIGHT CO., Toledo, O.—Creosoted wood blocks for factory floors will be displayed; represented by H. G. Jennison, Lloyd P. Drinker and Frank B. Goodman.

KELLOGG, SPENCER & SONS, INC., Buffalo.—Liquid core binders and pure linseed oil will be exhibited; represented by A. P. Mason, W. L. Goetz and R. C. Boggess.

KELLY, T. P., & CO., INC., New York.—The exhibit space reserved by this company will be arranged as an office and rest room for the convenience of the large number of friends of this concern; represented by H. F. Maurel, B. H. Forman, F. J. Rohe, H. J. Winters, V. C. Smith and W. F. Kaine.

KING, JULIUS, OPTICAL CO., New York. Safety goggles, helmets and safety appliances will be exhibited; represented by W. G. King, F. W. King, A. G. Larson, and J. J. Duffy.

LAMSON CO., Boston.—Conveyors of various types for foundry and general industrial use will be displayed. These include a gravity roller conveyor for handling pig iron, cores, etc., a parcel overhead carrier for carrying cores and other material from one foundry department to another, etc. All of the labor-saving and time-saving devices built by this company will be demonstrated by full size models and by photographs of installations. The American Pneumatic Service Co., which controls the 8-inch postal tubes operated in five cities of the country, will co-operate with the Lamson Co. in making this exhibit; represented by Fred B. Barton.

LEES-BRADNER CO., Cleveland.—A machine tool exhibit will be made by this company under the direction of its Boston agent, the Lynd-Farquhar Co. The exhibit will consist of a standard thread miller and a gear generator; represented by E. A. Bayton.

LEWIS-SHEPARD CO., Boston.—Elevating trucks which make possible the system of handling goods on platforms will be displayed; represented by A. L. Lewis, J. W. Adams and E. E. Wallace.

LUPTON'S, DAVID, SONS CO., Philadelphia.—Models of the rolled steel products for light and ventilation manufactured by

this company, will be shown and detailed drawings as well as photographs of installations will be on display; represented by Clarke P. Pond, C. F. P. Buckwalter and H. R. Wilkinson.

LYND-FARQUHAR CO., Boston.—A 26-inch combined open side crank planer and shaper will be exhibited in operation. This is a new combination machine embodying all of the features of a planer with the quick motion of the shaper. In addition, a Lees-Bradner gear generating machine and a thread milling machine will be exhibited in operation; represented by Ralph Streeter, Howard L. Rich, John S. Alcorn and E. A. Bayden.

MAHR MFG. CO., Minneapolis.—Foundry torches for cupola lighting, mold drying, preheating, etc., will be shown, as well as melting, rivet and forging furnaces; represented by J. A. Mueller, J. R. Matthews, R. B. Ecker, J. A. Mahr and H. H. Warner.

MALLEABLE IRON FITTINGS CO., Branford, Conn.—The complete line of vibrators, sizes ⅜ to 2 inches, inclusive, mounted for demonstration purposes will be shown, as well as the complete line of vibrator accessories made by this company, including knee valves, blow guns, starting valves, hose clamps, etc.; represented by G. B. Pickop and J. C. Page.

McCORMICK, J. S., CO., Pittsburgh.—A complete line of foundry supplies and facings will be shown as well as large cores coated with the blacking manufactured by this company; represented by J. S. McCormick, T. E. Malone, S. R. Costley and A. T. Richardson.

McCROSKY REAMER CO., Meadville, Pa.—A complete line of adjustable reamers, quick-change chucks and collets for drilling, tapping, stud-setting, etc., will be exhibited as well as turret tool posts for lathes, tap and die holders for turret lathes, universal lamp brackets and other time-saving devices for the machine shop; represented by C. M. Sutton and Clyde Derby.

McLAIN'S SYSTEM, INC., Milwaukee.—Samples of semi-steel castings of light section, such as automobile cylinders, pistons and other castings containing from 20 to 50 per cent steel, made by McLain graduates, will be displayed. Open-hearth steel castings poured from metal made in a McLain-Carter oil-fired furnace, also will be shown; represented by David McLain, I. V. Scanlan and Carl Huebl.

MICHIGAN SMELTING & REFINING Co., Detroit.—Ingot brass, bronze, tin and lead products including lead pipe, solders, babbitt and type metals will be displayed; represented by Joseph Stillman, Henry Levitt, Wm. J. Schweitzer, James Tiernan, E. E. Berliner, H. D. LeBel, R. H. Evans, R. R. Arnold and R. E. Moore.

MIDLAND MACHINE CO., Detroit.—All of the molding machines to be shown by this company will be operated and will include a small jar-ramming roll-over machine; hand-rammed roll-over machine and a small jar-ramming roll-over machine for making cores, designed for light operation by women in the core room if necessary. Motion pictures of the machines in operation in various plants will form a feature of this exhibit; represented by Geo. L. Grimes, L. V. Grimes, C. R. Jones and Oswald Carliss.

MOLTRUP STEEL PRODUCTS CO., Beaver Falls, Pa.—An extensive display will be made of flattened steel pattern plates, core plates, finished machine keys, finished machine rack and cold drawn steel bars; represented by N. S. Leyda and F. H. Guppy.

MONARCH ENGINEERING & MFG. CO., Baltimore, Md.—Types of the various line of foundry equipment, manufactured by this company will be exhibited, including several core ovens, showing the application of gas, oil, coal and coke as fuel and each oven will be of a different type designed to meet the requirements of various foundry conditions. Several crucible furnaces, designed for the use of gas, oil, coal and coke as fuel for the melting of non-ferrous metals, single and double chamber furnaces for melting metals without the aid of a crucible, oil and gas-fired annealing, tempering and hardening furnaces and in addition several auxiliary units which enter into general foundry equipment will be shown; represented by H. D. Harvey, James J. Allen, H. W. Raber, M. W. Woodburn and Frank Maujean.

MOTT SAND-BLAST MFG. CO., INC., Brooklyn, N. Y.—An operating exhibit consisting of a sand-blast tumbling barrel, hose-type machine, cabinet, exhausters, accessories, etc., will be made; represented by Davis Mayer, Louis Schroeder, C. B. Schneible, E. J. Rosenthal, Foster J. Hull, and E. C. Gilmour.

MUMFORD, E. H., CO., Elizabeth, N. J.—Samples of the line of molding machines manufactured by this company will be displayed; represented by T. J. Mumford, H. W. Sinclair and J. A. Walsh.

MUMFORD MOLDING MACHINE CO., Chicago.—Several of the different types of molding machines built by this company will be displayed and, in addition, enlarged cross-sectional drawings of the company's latest design of molding machine will be shown; represented by Donald Alexander, Otto F. Weiss, James T. Lee and W. H. Huelster.

NATIONAL ENGINEERING CO., Chicago.—An intensive sand mixer for foundry use will be shown in operation and literature will be distributed, describing a continuous core reducer and a screen separator; represented by H. S. Simpson.

NEW ENGLAND COAL & COKE CO., Boston.—A model of Bunker Hill monument will be reproduced from by-product coke. This replica will have a height of 45 feet, the base of which will be decorated with statuary and potted plants. Festoons of colored electric lights will be strung from the peak of the monument to each of the four standard-bearers on the four corners. Four statues, about 8 feet high, will surround the monument showing typical New England Puritans in the costumes of their time; represented by W. J. Lavelle, F. C. Knight, J. M. Dunbar and J. M. Taylor.

NEW HAVEN SAND-BLAST CO., New Haven, Conn.—A sand-blast rolling barrel and a medium size hose-type, sand-blast machine will be exhibited, as well as chilled shot, diamond grit, etc.; represented by C. A. Dreisback, C. E. Billings and C. S. Johnson.

NICHOLLS, WM. H., CO., INC., Brooklyn, N. Y.—Two combination jolt-ramming and power squeezers with automatic gravity drawing device will be exhibited, in addition to a plain power molding machine, a plain combination jolt-ramming and power molding machine and a combination jolt-ramming and power molding machine with roll-over device; represented by Wm. H. Nicholls.

NORMA COMPANY OF AMERICA, New York.—Ball bearings, roller bearings, precision testing instruments, etc., will be displayed; represented by E. A. Perkins.

NORTON CO., Worcester, Mass. — Four grinding machines will be shown in operation and these will be of the bench and floor types usually employed in foundries and provided with protection hoods. Grinding wheels used in foundry work also will be displayed; represented by George C. Montague, W. G. Snow, Herbert Duckworth and Wallace T. Montague.

OBERMAYER, S., CO., Chicago.—A full line of tumbling barrels, brass furnaces and other equipment and supplies for iron and brass foundries will be shown; represented by S. T. Johnson, E. D. Frohman, William Fenton, Wm. Fitzpatrick Sr., Wm. Fitzpatrick Jr., J. J. McDevitt, O. J. Peterson and George Deyette.

OLIVER MACHINERY CO., Grand Rapids, Mich.—A 16-inch tool room engine lathe will be exhibited in operation and in addition photographs will be shown of the complete line of pattern shop machinery and the universal wood milling machine built by this company; represented by J. W. Oliver, A. Blake, G. W. Crosley, A. S. Kurkjian and J. R. Duthie.

OSBORN MFG. CO., Cleveland.—The complete line of hand and power-operated molding machines manufactured by this company will be displayed; represented by H. R. Atwater, E. T. Doddridge, E. W. Jacobi, J. C. Alberts and E. J. Byerlein.

OXWELD ACETYLENE CO., Newark, N. J.—A complete line of oxweld equipment, part of which will be shown in operation, will be on display. This will include oxweld equipment of a low pressure type, an acetylene generating unit, and oxweld portable pressure generator in operation and welding and cutting blow pipes in representative applications, as made by oxweld users in New England and vicinity.

PANGBORN CORPORATION, Hagerstown, Md.—Photographs of various models and types of sand-blast and allied equipment, as well as samples of work done by these machines will be displayed in the booths fitted up by this company as a rest and reception room where telephone and stenographic service will be provided; represented by Thomas W. Pangborn, John C. Pangborn, W. C. Lytle, P. J. Potter, George A. Cooley, Alfred L. Holmes and C. M. Goldman.

PAXSON, J. W., CO., Philadelphia.—An extensive line of foundry equipment and supplies will be exhibited, including sands, facings, sand-blast machinery, etc. Photographs and blue prints also will be displayed showing the various lines of foundry equipment built by this company; represented by H. M. Bougher, W. S. Thomas, R. H. Rehm, E. M. Taggart, A. G. Warren and I. F. Kremer.

PICKANDS, BROWN & CO., Chicago.—A patriotically-trimmed display of Solvay coke in the form of a wheel hub with gilded wooden spokes wil be made; represented by Geo. A. T. Long, Thos. W. Glasscot, Bayard T. Bacon, Jas. A. Galligan, Jas. A. Ballard and Wm. H. Ball.

PITTSBURGH CRUSHED STEEL CO., Pittsburgh.—Samples of all sizes of angular grit used for sand-blast purposes will be exhibited; represented by G. H. Kann.

PORTAGE SILICA CO., Youngstown, O.—Samples of the silica sand, gravel and sand-blast sand, mined and prepared by this company, will be displayed, as well as the original rock from which this material is obtained. Photographs of this company's extensive plant also will be shown; represented by E. E. Klooz and L. R. Farrell.

PRICE, THORNTON W., Woolworth building, New York.—A model of the Ludlum electric furnace with samples of tool steel, pig iron, washed metal, iron and steel castings, etc., poured from metal made in this furnace will be exhibited. All of this material is being manufactured on a commercial scale by the Sweetser Bainbridge Metal Alloys Corp., which has several Ludlum electric furnaces in operation. Large photographs of this furnace also will be shown, together with analyses of these various products; represented by Thornton W. Price, G. E. Munro and O. D. Conover.

PRIDMORE, HENRY E., INC., Chicago.—The regular line of molding machines manufactured by this company will be shown and several new features will be introduced; represented by Charles H. Ellis, D. F. Eagan, A. V. Magnuson and J. W. Dopp.

QUIGLEY FURNACE SPECIALTIES CO., New York City.—A binding material

used for furnace linings will be displayed.

RICHEY, BROWNE & DONALD, Maspeth, N. Y.—Roller-ramming molding machines and sand handling appliances will be exhibited; represented by Walter Hofmann and Joseph B. Donahue.

RIVETT LATHE & GRINDER CO., Boston.—A back-geared precision bench lathe mounted on a cabinet with individual motor drive and attachments will be exhibited, together with two sizes of internal grinders complete with standard equipment. An improved threading tool also will be displayed; represented by Cecil Ogden, A. O. Richter, Fred Lord and F. H. Halstead.

ROBESON PROCESS CO., New York.—Cores made with glutrin and samples of that material will be shown, as well as some interesting photographs. The booth will be fitted up as a reception room and a useful souvenir will be distributed; represented by Geo. N. Moore, T. J. Ryan and R. S. Hughes.

ROGERS, BROWN & CO., Cincinnati.—An extensive display will be made of samples of pig iron representative of practically every grade manufactured by blast furnaces in the United States. Bee-hive and by-product cokes also will be shown, as well as an extensive assortment of ferro-alloys. Gray iron, semisteel and malleable iron castings, both ornamental and practical will be exhibited; represented by A. A. Fowler, W. T. Shepard, E. L. Billingslea, Geo. R. Sullivan, Richard Peters Jr., R. W. Clark, Otto Arlt, J. A. Claussen, Sterling W. Hubbard, Thos. E. Wilson, F. J. Waldo, A. T. Stengel, J. C. Mears, H. W. Fernald, F. E. Fitts, W. R. Maher, E. F. Bowden, F. W. Miller and F. W. Bauer.

SAND MIXING MACHINE CO., New York.—This exhibit will consist of a sand cutting machine; rotary table sand-blast room; humane sand-blast rotary table in which the operator stands outside and is immune from dust; large sand-blast tumbling barrel and a new type of humane sand-blast room for handling all kinds of small work; represented by V. E. Minich, H. L. Wadsworth, Hutton H. Haley, J. D. Alexander and Charles G. Smith.

SHEPARD ELECTRIC CRANE & HOIST CO., Montour Falls, N. Y.—Standard hoists built by this company will be displayed, including a foundry hoist, having variable speed control; a new light load capacity hoist, designed to take care of loads slightly too heavy for one man to handle; an electric hoist which is portable and applicable to cranes and derricks, and an enclosed electric winch, which operates in oil. In addition to the foregoing, a section of monorail track and T-bar conductor with insulators and accessories will be displayed. A set of enlarged photographs showing the entire Shepard line will be included in this exhibit; represented by F. A. Hatch, A. J. Barnes, R. H. McGredy, W. A. Battey, W. C. Briggs, W. B. Martwick, N. P. Farrar and H. W. Gledhill.

SIMONDS MFG. CO., Fitchburg, Mass.—Saws for cutting metals will be shown.

SLY, W. W., MFG. CO., Cleveland.—An extensive display of equipment for cleaning castings will be made, including a 10 x 10-foot sand-blast room, horizontal sand-blast barrel, sand-blast pressure tank and a sand-blast mill with dust arrester. In addition, a rosin mill and a two-section drawer type core oven will be displayed; represented by W. C. Sly, Geo. J. Fanner, P. W. Graue and H. P. Furlong.

SMITH, R. P., & SONS CO., Chicago.—Safety shoes for molders and foundrymen will be displayed; represented by J. B. Smith Jr.

SMITH, WERNER G., Co., Cleveland.—Core oils, cores made from these oils and castings in which cores have been used made from these core oils, will be displayed. In addition an extensive exhibit will be made of different grades of plumbago facings; represented by Werner G. Smith, Frank H. Dodge, Milton S. Finley, Albert L. Fay, L. P. Robinson, W. E. Rayel and Louis F. Ferster.

STANDARD EQUIPMENT CO., New Haven, Conn.—A water cinder mill will be shown in operation; represented by Chas. A. Dreisbach and Louis Bradley.

STERLING WHEELBARROW CO., West Allis, Wis.—In addition to having its booth fitted up as a rest-room for the convenience of visiting foundrymen, it will exhibit its line of steel flasks, foundry wheelbarrows and foundry specialties such as wedges, skim gates, etc.; represented by I. R. Smith, H. H. Baker, J. M. Dickson, Geo. H. Lambkin, Edw. Dowd, J. W. Dopp, J. J. Coyne and Chas. L. Kirk.

STRONG-KENNARD & NUTT CO., Cleveland.—A general line of safety devices will be shown, including goggles fitted with non-splintering glass, respirators, leather asbestos leggings and gloves, safety signs, first aid cabinets, hospital furnishings and equipments, fire extinguishers, sand-blast, dust helmets and many other safety supplies. The non-splintering glass used in the goggles is made by putting together two pieces of glass and welding them with material similar to celluloid. In appearance, the lenses are the same as the ordinary goggle lenses, but the advantage of their use is, that even though cracked, they will not splinter owing to the interlining which holds all the chips; represented by Buell W. Nutt and Walter Marken.

SULLIVAN MACHINERY CO., Chicago.—An angle-compound compressor, 14 x 8¾ x 10 inches, equipped with improved plate valves throughout will be installed, which will supply air for the operating exhibits in the foundry machinery and machine tool sections. This machine will be driven by a 75-horsepower General Electric motor. Its capacity at 250 revolutions per minute is 445 cubic feet of free air against a terminal pressure of 100 pounds per square inch. In addition, plate valves of the end-rolling finger pattern will be shown. An 8 x 8-inch, belt-driven, single stage compressor, of the splash-oiled, totally-enclosed type will be exhibited in addition to air lift pumps and an air booster for securing water supply from wells. A photographic exhibit also will be made of other classes of Sullivan air compressors; represented by G. E. Wolcott, H. C. O'Brien, G. H. Richey and Alexander Milne.

THOMAS IRON CO., Boston.—Samples of the various grades of pig iron manufactured by this company will be shown.

TITANIUM ALLOY MFG. CO., Niagara Falls, N. Y.—Ferro-carbon-titanium manufactured by this company will be exhibited and in addition there will be held a display of castings manufactured by the Titanium Bronze Co., of Niagara Falls, allied with the parent company. The Titanium Alloy Mfg. Co. will be represented by G. A. White, Wm. J. Evans and Wm. V. Knowles. The Titanium Bronze Co. will be represented by H. R. Corse and A. C. Olfs.

UNITED COMPOUND CO., Buffalo.—Wax wire for venting cores and wax for use on patterns will be displayed; represented by John W. Bradley and L. F. Leney.

UNITED METAL HOSE CO., New York City.—Flexible metal hose of various types will be exhibited, including armored metal, lined, welding, air, pneumatic tool, metal armored sand-blast, metal hose for steam, and metal-lined hose for oil; represented by Joseph M. Lewin.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—Samples of graphite foundry facings will be displayed; represented by A. W. Walker, J. G. Drought, R. A. Corrigan, F. B. Godard and H. F. Gump.

U. S. MOLDING MACHINE CO., Cleveland.—Six different types of molding machines, manufactured by this company will be shown in operation, including a plain air squeezer, combination jar-ramming and squeezer molding machine, combination jar-ramming, squeezer and pattern-drawing machine, combination jar-ramming and pattern-drawing machine, combination jar-ramming roll-over and pattern-drawing machine and a plain air-operated jar-ramming machine; represented by J. N., C F. and J. L. Battenfeld.

UNITED STATES SILICA CO., Chicago.—Samples of the flint shot made by this company will be exhibited. Photographs of plants where this material is produced as well as photographs of customers' plants and product will be shown in addition to the photograph of this company's new plant; represented by A. Volney Foster, Lewis B. Reed, Harry F. Goebig, and Oliver Cook.

WALLACE, J. D., & CO., Chicago.—A bench planer will be shown in operation, equipped with a special flap and shutter safety guard; represented by J. D. Wallace.

WARNER & SWASEY CO., Cleveland.—The machine tool exhibit that will be made by this company will consist of a universal hollow hexagon turret lathe, operating on bar work; a universal turret screw machine, operating on bar work and a plain head turret screw machine. All of this equipment will be motor-driven; represented by A. C. Cook and H. L. Kinsley.

WHEELER & HOLCOMB CO., Chicago.—A display will be made of "safety first" wearing apparel, including gloves and mittens made from asbestos cloth and leather. Leggings will be shown made of asbestos cloth, fireproofed duck cloth and chrome leather. In addition, aprons will be shown, made of asbestos cloth and fireproofed duck, as well as spats, short leggins, hip leggins, suits, hand leathers and other apparel for protecting foundry and steel works operators; represented by F. H. Wheeler and Charles A. Kingsbury.

WHITE & BRO., INC., Philadelphia.—Ingot metals of all kinds will be shown including the company's two brands of copper ingots, as well as castings made from these ingots; represented by Frank Krug.

WHITEHEAD BROTHERS CO., Providence, R. I.—The booth to be occupied by this company will be fitted up as an office and rest room for the reception of friends of this concern; represented by A. J. Miller, J. H. Whitehead, V. L. Whitehead and Charles E. Andrews.

WHITING FOUNDRY EQUIPMENT CO., Harvey, Ill.—The foundry equipment that will be displayed includes a 10-ton crane trolley, a teapot spout ladle and a round plate barrel tumbler. In addition, photographs and drawings of the extensive line of foundry machinery manufactured by this company will be exhibited; represented by R. H. Bourne and C. A. Hardy.

WOODISON, E. J., CO., Detroit.—An extensive display of foundry equipment and supplies will be made, including an electrically-operated jolt-ramming roll-over molding machine, wood grinder, core oils, buffing compositions, etc.; represented by E. J. Woodison, D. H. Woodison, G. A. Burman, U. W. Frink, W. J. Wark, W. M. Maybank, W. Renchie, D. D. Baxter, H. T. Taylor, C. G. Howe, G. Brady and C. J. Skeffington.

WOOD'S, T. B., SONS CO., Chambersburg, Pa.—Tapered snap flasks and automatic adjustable snap jackets will be exhibited as well as flasks in various sizes fitted with pin equipment, designed for the different methods of snap molding. Jackets in corresponding sizes also will be displayed adapted for a wide range of snap flask work; represented by Chas. M. Wood, Geo. M. Naylor and Victor Lesher.

Artistic Gray Iron Castings Made by Russian Foundrymen in the Ural Regions

GENERALLY speaking, the Russian is credited with little taste for the finer arts. This is particularly true of the lower castes of industrial workers. By nature he is phlegmatic; struggling through generations against the oppressions of a rigorous climate and a harsh government, his tendencies are naturally bent toward the elemental. Yet in the southeastern part of Russia, where the rugged ranges of the Urals push their rocky peaks above the more fertile plains of the Steppes, the native foundrymen and molders who can neither read nor write have made some of the most remarkable and artistic gray iron castings to be found in the world. Illustrations on this and the three following pages show a number of Russian castings taken from the private collection of John A. Penton, of Cleveland. Most of the smaller views represent the actual size of the castings. Several of the views, however, illustrate castings which are 12 and 14 inches high and proportionately wide. High phosphorus iron made in the Ural regions has been famous for years for the production of light, thin castings, and for this reason it is especially suitable for art castings which must reproduce closely the sculptor's original statue in the many intricate details. The Ural iron is also very white. Although but dimly revealed by the photographic reproduction illustrated here, the fine lines showing facial expressions, muscular actions and other important details are indicative of a keen appreciation of art and wonderful skill. The castings are made largely in one piece, but in several cases where the figures are more or less complicated, the foundrymen had to resort to the expedient of casting the component parts individually. The accuracy of the work is so remarkable that it is almost impossible to ascertain where the several parts are joined. The foundries where these art pieces are made are under government control and the castings all bear the official seal. Previous to the revolution, export of these marvelous castings was prohibited. October and November issues of THE FOUNDRY *will show some of the ingenious work of German foundrymen.*

The Cossacks on Horseback—This gray iron reproduction of a famous statue in Moscow is a masterpiece by the Ural foundrymen—The finish closely resembles polished bronze

Russian molders find art in the most commonplace things in life—Here the foundryman has faithfully preserved each detail of the coal miner and his sleigh

Diana — the Virgin Huntress—True in every detail of poise and expression to the artist's original

Bench Molder—Even the illiterate and phlegmatic Russian appreciates the existence of art in industry—Simple tools suit his purpose

Three Niebelungen Dwarfs—Symbolical of the characters of an old legend

Russian soldiers dance to Kerensky's music today

The Wild Boar at Bay—Although cast in several pieces, the separate parts are made so accurately that the joints are almost impossible to find in the assembled casting—Intensity of action is depicted with all the clearness and detail of actual life

All the amazing skill and dexterity of the molder are shown in this casting of a Russian sleighing party—The ruggedness of life in the Ural Mountain iron regions appeals strongly to the native foundryman's sense of art

A native of the Steppes—The stocky horse is a familiar figure in the world-famous iron mines of the southeast

Will the Russian soldier regain his position on the solid pedestal of fame?—The Allies are anxious to see him there

Capable of hitting the mark: but is he aiming east or west?

The native Russian is a keen lover of animal life—The position and muscles of the hunting dog show that he is rapidly running his quarry to earth

Cub Bear at Play

The actual casting is no bigger than this view but every detail stands out prominently

After the Partridge—The dog in the foreground is the same one shown at the top of the page—His companion seems to be pursuing a policy of watchful waiting—This casting is another proof of the artisan's appreciation of nature and outdoor sports

Molding and Coring a 5-Ton Gear Cutter Bed

How One Foundry Rigged-Up for Work for Which the Plant Was Not Designed and How Satisfactory Results Were Obtained

By Wm J Kihn

UNDER present industrial conditions, with shops designed for one line of work taking on other classes, and with capacity crowded to the limit, any methods which tend to increase the tonnage per unit of floor space, without extensive additions or changes, are of great value. As an example of what can be done a description of some of the methods practiced at the Gurney Electric Elevator Works, Honesdale, Pa., will be of interest.

Originally the foundry was designed to handle elevator work exclusively, but it now is handling also a line of machine tools in addition to its regular work. The foundry is equipped with one 10-ton crane and has a melting capacity of 7 tons per hour.

A short time ago the foundry was called upon to make the castings for a number of 96-inch gear cutters. The beds of these machines, with which the present article deals, weighed 10,300 pounds and required 11,000 pounds of cores per casting. The overall length of each bed was 13 feet 9 inches.

Two molders and a helper rammed-up the job in two days, 36 hours having been allowed to skin-dry the bed and 1½ days were consumed in covering-up and getting ready to cast. Beginning Monday, therefore, the job was ready to cast Friday afternoon. A large amount of dry sand work having been necessary, however, it was possible to cast only every other day, and consequently, the first casting was poured on Saturday.

Difficulties Overcome

It was necessary to get one casting per week and to do this under these circumstances meant two pits, with the resultant duplication of rigging and the tying-up of a large amount of valuable floor space, or shaking-out the casting on Monday and preparing the pit for work on Tuesday.

However, shaking-out this particular casting in such a short time presented difficulties, due to the fact that it was not permissible to hold down the five body cores, *A, B, C, D,* and *E,* Figs. 1 and 3, with chaplets, as the base or bottom of the casting, which was made in the cope, had to be oil-tight. This necessitated bolting these five cores to a frame in the bottom of the pit, and, as the tops of the cores when placed in the mold, were inaccessible after casting, a method of release for the cores from the bottom of the pit, that would be quick and positive had to be devised.

Fig. 2 shows the pit frame in place. It has machined lugs on the sides for straight edges, and a number of lugs in the center which have holes cored through them taking a 1-inch rod to which a chain is hooked. The chain runs through a sheave, whose bearing is cast integral with the frame, but outside the line of the casting. The bolts, by which the frame is secured to three binders are visible in front of the straight edge lugs. The tie bolts to secure the cope are fastened to these binders and the tops are

The author is superintendent of the foundry of the Gurney Elevator Works, Honesdale, Pa.

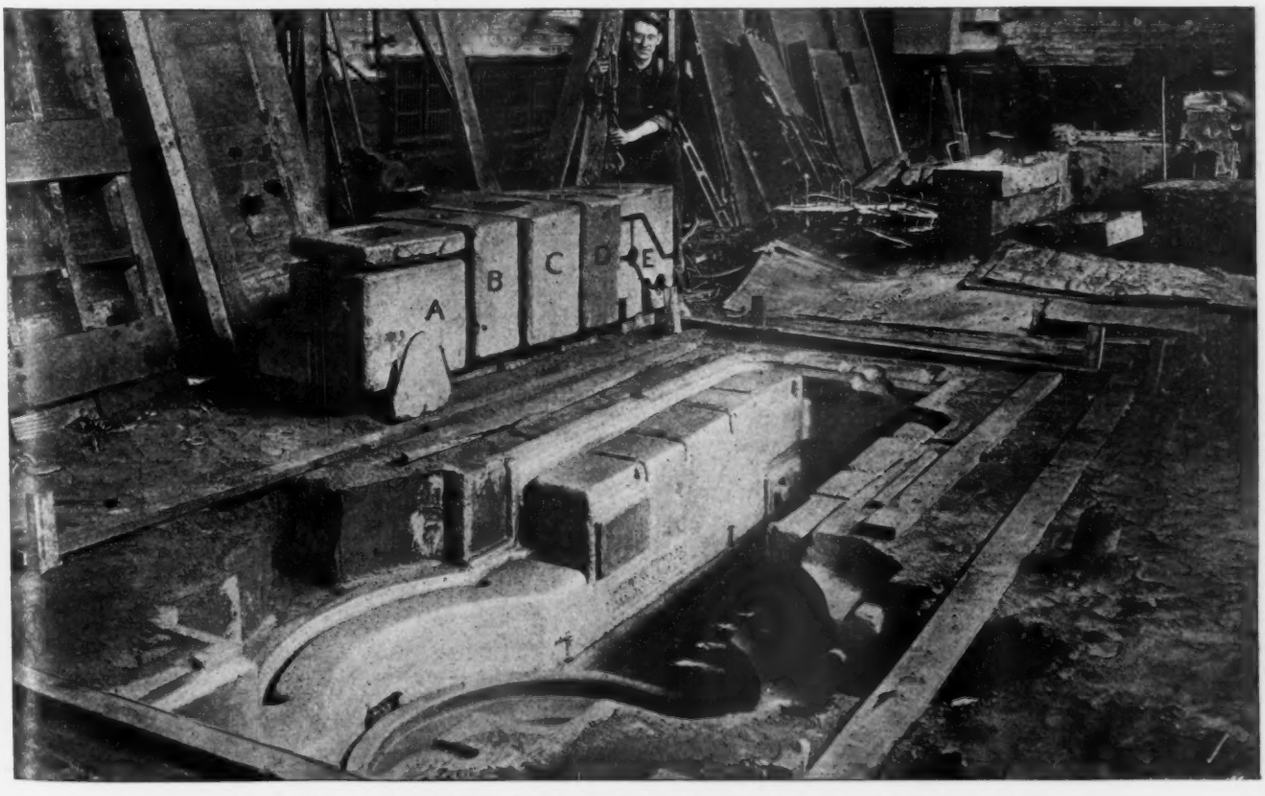


FIG. 1—DRAG OF A 96-INCH GEAR CUTTER BED MOLD READY FOR THE CORES

FIG. 2—THE MOLDING PIT SHOWING THE PIT FRAME IN PLACE
FIG. 4—THE DRAG HALF OF THE MOLD CORED UP

FIG. 3—LOWERING THE MAIN BODY CORE INTO THE MOLD
FIG. 5—THE MOLD READY TO POUR

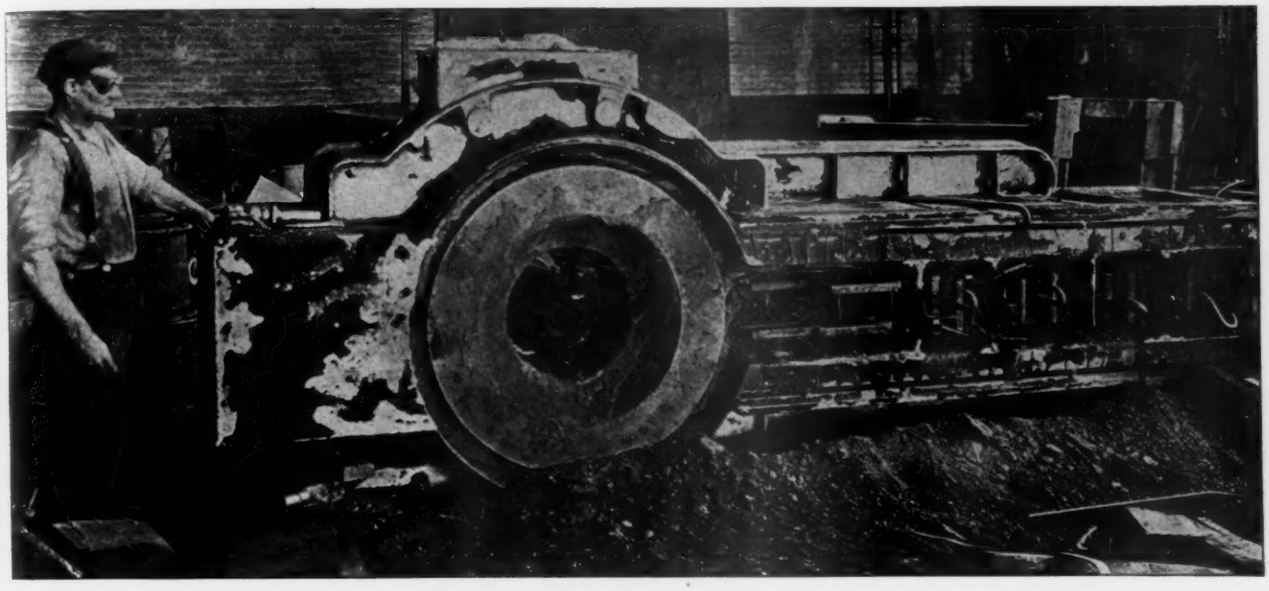


FIG. 6—THE BED CASTING REMOVED FROM THE PIT AND ROLLED OVER ON ITS SIDE

shown in Fig. 2, directly behind the stands which support the cope.

To carry off the gases satisfactorily, a cinder bed was built through the center of the pit, directly underneath the lugs on the frame, which was connected to the vent pipes at the side of the pit. Two of these pipes are shown in Fig. 1, being stuffed with burlap to prevent sand from falling into them and sealing the vent. Straight edges were clamped to the side lugs and so adjusted that the floor of the pit, which coincided with the print for the body cores, was flush with the tops of the center lugs. A little flour marked the location of the lugs in Fig. 1, the rod and chain having been rammed-up under the pit floor. After drying, it was a comparatively simple matter to dig out the sand between the lugs, connect to the cinder bed and then to proceed with the coring Long hook bolts, the ends of which are protruding from the cores in Fig. 6, were hooked under the rod extending through the lugs. The five cores then were lowered over these rods and were secured with a nut on the top end of the rod. The space through which the rod passed was filled with cinders and the holes in the tops of the cores were filled with sand and dried, leaving the mold as shown in Figs. 3 and 4. The main core, to which six smaller pocket cores were bolted, then was lowered into position as illustrated in Figs. 3 and 4.

Fig. 5 is a view of the job ready to pour. The cope was not dried, but was cast green. The bulk of the job was poured from an 8-ton ladle, but it was considered advisable to cut a gate under the joint on the opposite end of the casting to supply about 1500 pounds of hot, fluid metal just before the mold was filled, to make certain that the oil pan would not show cold-shut marks.

After casting, and before taking off the cope, the chain attached to the rod to which the hook bolts were secured, was started with the crane. A slow, steady pull, coupled with a few blows on the chain, caused the rod to slide out of its position underneath the casting and come up to the sheave. When this point was reached, the cores were known to be free. The gates were bared on one end of the casting and two chains were hooked around them. The crane readily lifted one end free, which then was blocked up. Next, a chain was thrown around the center and the whole load was taken to the scratch

(*Continued on page 387*)

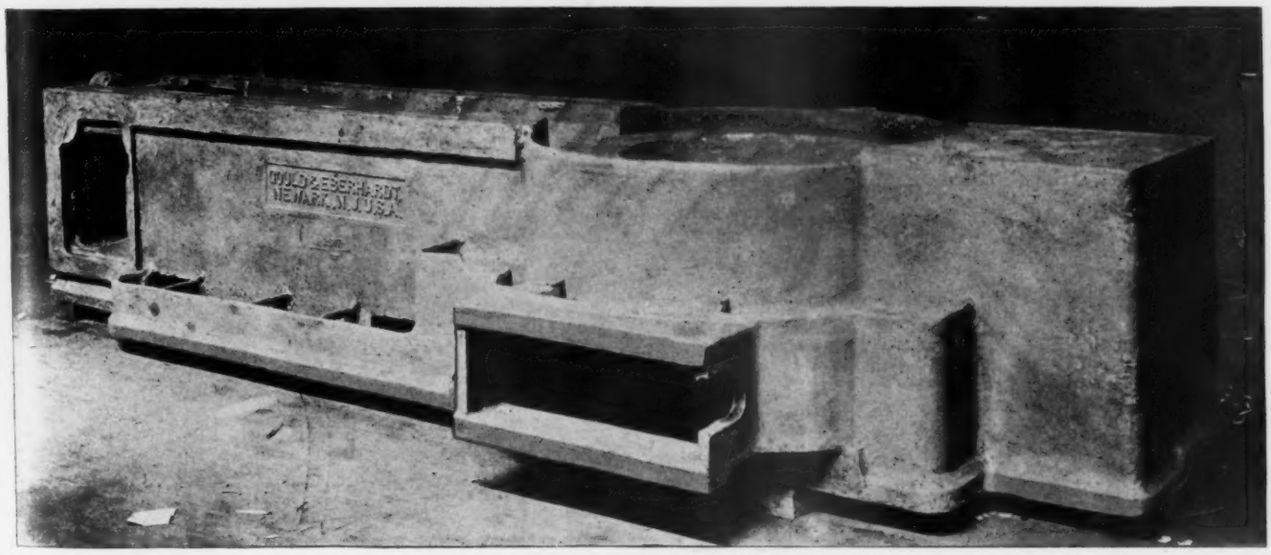


FIG. 7—THE BED CASTING FOR A 96-INCH GEAR CUTTER

FIG. 2—THE MOLDING PIT SHOWING THE ARRANGEMENT OF THE VENT PIPES
FIG. 4—THE DRAG HALF OF THE MOLD COREDUP

Propeller Casting is Essential to Our Defense

Foundrymen Now Will be Required to Make Cast Parts for Ships and a Simple Method of Making Wheels is Here Described

By R H Palmer

AMONG foundrymen generally unusual interest is being manifested in the production of castings for ships. The tremendous shipbuilding program outlined by the government is unparalleled by any similar undertaking. Regardless of whether these vessels are built of wood or steel, they will require thousands of tons of steel, gray iron, brass and bronze castings and the services of many casting manufacturers will have to be enlisted to whom this class of work marks a venture into an unknown field.

Owing to its unusual contour, the welding and casting of the propeller, whether by single blade or integral, seemingly presents the greatest difficulties. Naval architects, also, are inclined to vary the pitch of propellers to meet unusual conditions and the pitches are almost as numerous and varied as the sizes and weights of these castings. The responsibility of matching theory with fact devolves upon the foundryman and he frequently is called upon to meet weird specifications. To foundrymen located on the Atlantic and Pacific coasts, the production of propellers does not present many problems, but the newcomer in this line of work may be compelled to carry on many experiments before he succeeds in making a sound casting. Foundrymen who have specialized in propeller work have designed many novel methods to expedite production and the system to be described is simple and reduces to the minimum the necssary flask equipment. The method of

FIG. 1—A 12,000-POUND PROPELLER FOR A PASSENGER LINER WITH A MOTOR BOAT WHEEL IN ITS BORE

FIG. 2—PROPELLER MOLD AFTER REMOVING WEIGHTS AND CLAMPS AND JUST BEFORE SHAKING-OUT. THE RISER IS SHOWN AT *C* AND *D* IS A PIPE PLACED OVER THE VENT IN THE CORE

molding the hub also is novel and effects economies in labor costs.

A propeller mold with the weights removed, just before shaking-out, is shown in Fig. 2 and in Fig. 3 the cope halves of two of the blades have been removed and the gates and riser also are shown. Four flasks are used, one for each blade, which are so ingeniously joined together by the hub to make practically one flask, as illustrated in the top plan of the mold, Fig. 6.

When making the mold a core is used to form the bottom of the hub, which contains a print for the center core and a hole in its center through which the spindle is passed to its seat underneath the core. The four drag flasks then are centered around the spindle to form a cross, as shown in Figs. 2 and 3. Coke or cinder is rammed into the deep side of each flask

FIG. 4—PATTERNS FOR A WIDE ASSORTMENT OF PROPELLERS THAT CAN BE MOLDED IN ONE SET OF FLASKS

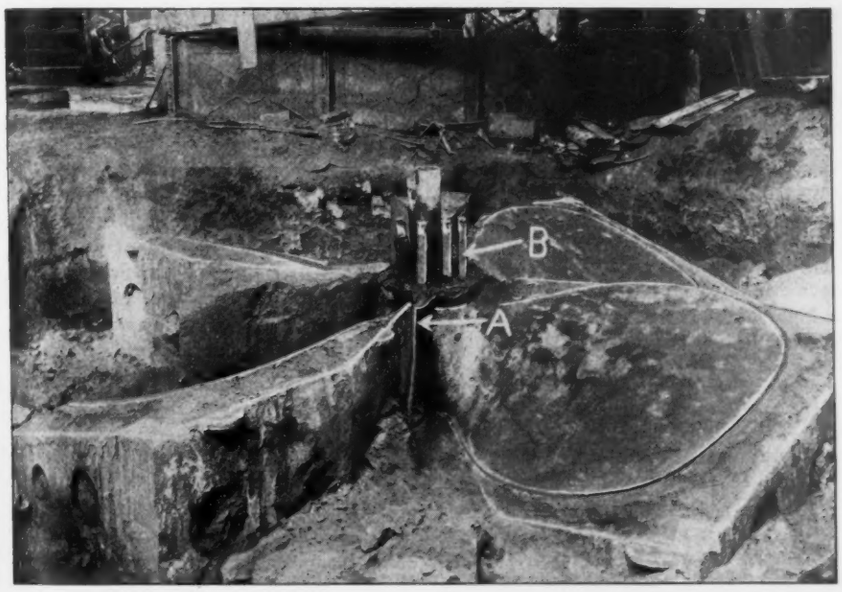


FIG. 3—PROPELLER PARTLY UNCOVERED SHOWING THE GATES AT *B*

to the line *A*, Fig. 8, and sand is rammed on top of this to a point about 4 inches below the line where the blade pattern will rest. The wood core print then is lowered over the spindle into the print in the bottom core and the pattern is lowered onto the spindle. A collar, provided with a set screw, holds the hub in place on the spindle. The blade of the pattern is supported by wood cross-pieces which are clamped to ears on the sides of the flasks. Sand next is rammed underneath the pattern blade and a joint is made conforming to the lines of the pattern. The cope half of the flask then is lowered over the pattern and the ramming of the propeller blade is completed.

Since this flask equipment is used on a wide range of sizes of propellers having varied pitches and hubs, it is necessary to resort to numerous expedients to adapt the cope flasks to these patterns. In Fig. 4 is shown an assortment of propeller patterns all of which can be molded by this flask equipment. The pattern, *A*, in the foreground, is for a propeller 11 feet 4 inches in diameter, which weighs 7500 pounds. A wheel cast from this pattern is shown on the boring machine, Fig. 5. Other patterns in Fig. 4 are for wheels from 8 to 14 feet in diameter, the latter weighing 14,000 pounds. A propeller for the steamer NEW HAMPSHIRE, one of the Long Island sound boats of the New England Steamship Co., is illustrated in Fig. 1, and in the bore of this propeller is a small wheel for a launch, also molded and cast in this foundry.

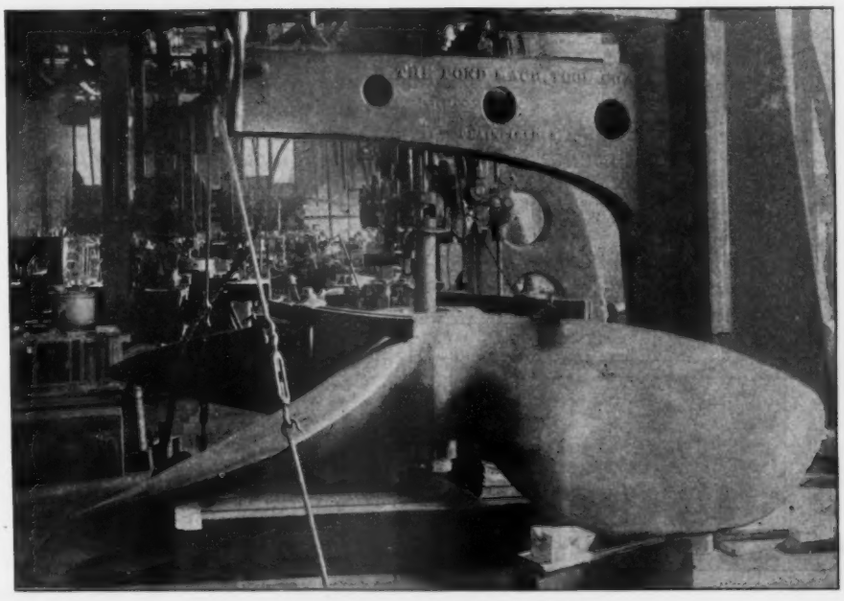


FIG. 5—BORING A LARGE PROPELLER

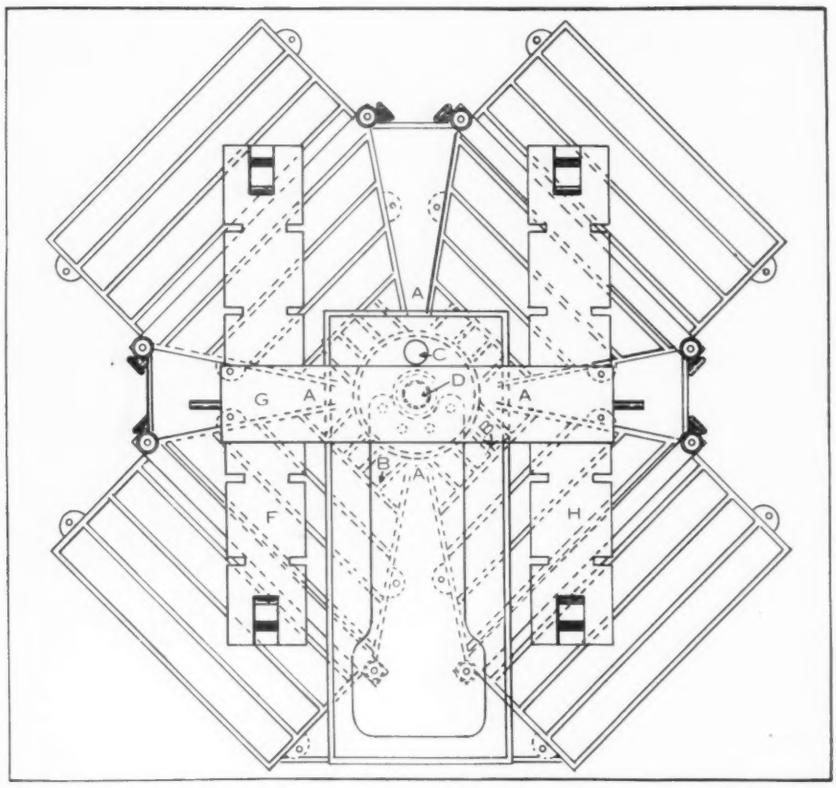


FIG. 6—TOP OF A PROPELLER MOLD SHOWING GATES, RISER AND WEIGHTS

Owing to the differences in the pitch of the blades of the different patterns, the bars of the copes in many cases are as far distant from the pattern as 8 inches, and to support the hanging sand, loose chucks, *B*, Fig. 6, are hung onto the bars, in addition to rods which are bent to shape especially for this purpose. Chucks forming the points of the flasks next to the hubs are bolted in position. After the cope flask has been properly prepared for the pattern, it is rammed and lifted off.

The hubs of some wheels are of such a form that the pattern can be raised on the spindle and swung around to the next drag. However, some hubs are of such a design that it is necessary to lift out the spindle when drawing the pattern.

To assure the accurate centering of the pattern in the flask for the next blade to be molded, a large wood square, in the form of a cross is employed. This device is shown at *A*, Fig. 2. Through a hole in its center it is lowered over the spindle to accurately locate the blade

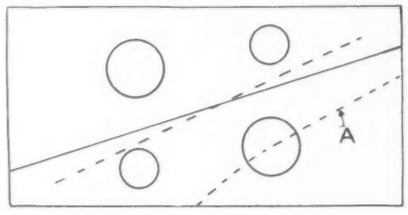


FIG. 8—HEIGHT OF CINDERS AND LOCATION OF PATTERN IN FLASK

pattern in the adjoining flask. Before the pattern is drawn from the mold just made, the parting of the drag is marked to coincide with a mark on the pattern and these lines, with the aid of the squaring device, make it possible to locate the pattern accurately in the adjoining flask. The foregoing operations are repeated for each of the blades, which are molded independently of each other. The molds then are finished, coated with blacking and dried. The copes are dried in an oven, while the drags are dried in the position in which they are molded.

After drying, the copes are replaced, but it will be noted that the four-blade molds do not form a perfect hub at the four points, *A*, Fig. 6. After the copes have been bolted to the drags, false pieces are inserted at the points, *A*, Fig. 6, to complete the hub. Sand is rammed against these false pieces to complete the hub section of the mold, after which it is coated with blacking and dried with fire baskets.

The center core, *A*, Fig. 7, then is set in place. The part of this core, shown at *B*, forms the top of the hub of the casting. This hub core is beveled on the edge, and in molding this print in the copes, the sides are sloped to conform to the level on this bead on the center core. After the center core is set, waste is tucked into the openings around the head of the center core and gate sticks are placed in the gate hole in the core. To form a riser, a piece of pipe is placed at *D*, Fig. 6. Sand then is rammed over the core. The mold then is bolted and weighted down, as shown at *F*, *G* and *H*, Fig. 7. The gate sticks then are withdrawn, the

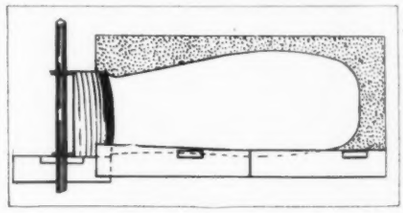


FIG. 9—HOW THE PATTERN IS SUPPORTED ON A SPINDLE WHILE IT IS BEING MOLDED IN THE DRAG

runner is built and the mold is ready for pouring. To hold down the center core, wedges *E*, Fig. 7, are driven between the weight *G* and the section of pipe to hold down the center core *A*.

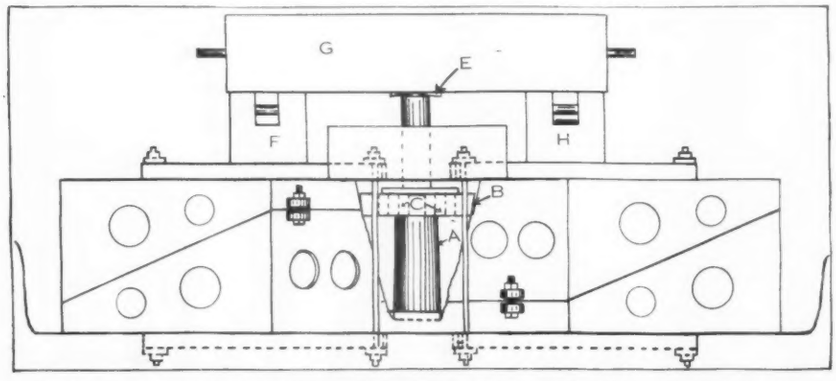


FIG. 7—PART SECTION OF PROPELLER MOLD, SHOWING HUB CORE IN POSITION

The New York office of White & Bro., Philadelphia smelters and refiners, has been removed to 821 Trinity building. G. C. Dickinson is in charge.

Being compelled to seek larger quarters, the New York office of the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., has been removed from 50 to 30 Church street. For the same reason, the Philadelphia office of this company has been removed from the Stephen Girard to the Bulletin building.

Selenium in Copper

Selenium, when added to copper, produces unusual results. The addition of 0.5 per cent produces castings that contain minute pits which are regularly distributed and are similar to pin holes. After pouring, the copper swells in the risers and sprues, curving up at the edges, leaving the top slightly convex. The surfaces of both sprues and risers were smooth when solid, and while the liquid metal was coming up in the risers, only a very slight spitting was noted. Before being poured, the copper was very fluid.

The most remarkable feature of the copper was that its properties were entirely changed by the addition of this small amount of selenium. Instead of being tough and difficult to work with machine tools, the copper could be cut easily. A bar, 1½ inches square, was cut by a hack saw with little effort. The copper was not brittle and could be bent double without cracking. The effect of selenium on copper and its alloys appears to be much worse than that of sulphur. This element is used extensively in alloys containing high percentages of lead, as it prevents segregation of this metal. Neither selenium nor tellurium can be used for this purpose, although they bear a close resemblance to sulphur. It naturally would be assumed that since the boiling point of selenium is higher than that of sulphur it would have a better effect than sulphur as a lead retaining agency.

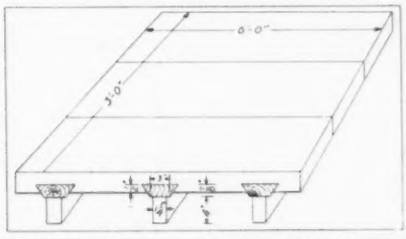
Seaman-Sleeth Co. is Sold and J. S. Seaman Retires

The properties of the Seaman-Sleeth Co. and the Phoenix Roll Works, Pittsburgh, have been purchased by William Morris Imbrie & Co., New York bankers, for $2,000,000 and have been formally transferred to the Pittsburgh Rolls Corp. After negotiations for the purchase were concluded, a meeting of stockholders and directors was held in the offices of Clarence Burleigh, a corporation lawyer, Frick building Pittsburgh.

The new concern has been capitalized at $3,000,000, of which $1,000,000 will be 6 per cent first mortgage gold bonds, $1,500,000 common stock and $500,000 7 per cent cumulative preferred stock. In addition, $1,000,000 of common stock is reserved for the conversion of bonds.

Officers of the Pittsburgh Rolls Corp. follow: Chairman of the board, Joseph S. Seaman, who had been president of the Seaman-Sleeth Co.; president, David L. Eynon, who had been general manager of the Seaman-Sleeth interests; vice president and treasurer, H. R. Warfield, for 10 years connected with William Morris Imbrie & Co.; secretary, H. H. Meckley, who had acted as secretary of the Seaman-Sleeth Co. Mr. Warfield represented the purchasers in the transaction. He has been actively associated in organization work for a number of years and is vice president of the Savannah & Atlanta railroad and one of the receivers of the Georgia & Florida ralroad.

The Seaman-Sleeth Co. was organized about 60 years ago by J. S. Seaman and associates. For almost 50 years, the company has specialized in the manufacture of chilled and sand rolls and pinions; it enjoys an extensive trade in this country and has exported many rolls to Canada, Mexico, Australia and Japan. The net profits of the company for 1912-1916 were $742,992.57. In 1915, the net earnings of the company were $296,144.58 and the net profits for the first four months of 1917 were $104,-993 59. The company has been extending its manufacturing facilities ever since its origin. An open-hearth steel furnace now is being installed.



CONSTRUCTION BOARD OF THREE PLANKS HELD TOGETHER BY DOVETAILED CROSS RAILS

In co-operation with the bureau of mines, an investigation of the electric melting of brass is being conducted at Cornell university, the electric furnace equipment being installed in Morse hall. The experiments indicate that the use of a suitable electric furnace will materially reduce melting losses and the bureau of mines now is testing an electric furnace built according to the design worked out by the laboratory tests. This furnace is of commercial size and is being tested with a view to ascertaining its suitability for such processes as are used for cartridge and shrapnel cases.

A 10 per cent aluminum bronze to which was added 1 per cent of 30 per cent manganese-copper had the following physical properties: Ultimate strength, 63,800 pounds per square inch; elastic limit, 19,700 pounds per square inch and elongation in two inches, 49.3 per cent.

A Patternmaker's Construction Board

By M. E. Duggan

Every patternmaker appreciates the advantages of a well-made table or construction board, on which he can lay out and build-up his pattern in a practical manner and with a feeling of confidence in the accuracy of his measurements.

In one large shop, the construction board is considered just as necessary as a bench or any of the other tools in the pattern shop. Each patternmaker is furnished with one of these boards of standard design and dimensions. The wooden horses also conform to a standard drawing.

The boards are constructed of 2 x 12-inch well-seasoned pine planks, fastened together by dovetail cross rails, as shown in the accompanying illustration. Maple is used for the dovetails, although it is common practice to joint and fasten the boards of a table together with glue. In this particular shop no glue is used in the construction of the table. Construction boards frequently require top dressing. The glued boards must be dressed by a hand plane, a slow and unsatisfactory method. When glue is not used, the dovetail cross rails can be removed, and a light cut taken over the top surface by passing each board through a power planer. The three boards are then assembled and the table is ready for use, the work requiring little labor or loss of time.

Every pattern returned from the foundry is covered, more or less, with sand and grit, and when one of these patterns is placed on the construction board, much of this sand and grit is ground into the board. Sand and grit in a board that is to be planed spells destruction to edge tools. Therefore, if convenient, the boards should not be dressed at a time when the planer knives are in good cutting condition. In many instances the job can be reserved until the planer knives require re-sharpening.

How to Melt Babbitt Metal

When melting babbitt metal in a kettle the surface of the metal always should be kept covered with powdered charcoal and the temperature of the bath should be maintained at approximately 500 degrees Cent. Before being ingoted, this temperature should be lowered somewhat for both lead and tin base alloys and 450 to 470 degrees Cent. will be found to be a good pouring temperature. When the babbitt is being run directly into bearings, the shell should be heated to about 100 degrees to prevent blowholes. A Brinell hardness of 23.5 for lead base and 30 for tin base alloys is considered best.

How the Foundry Was Dressed W

Personal Reminiscences of the Founder of This P

Experts in Their Respective Branches of Casting

THE FOUNDRY

Vol. I. SEPTEMBER, 1892. No. 1

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DETROIT, SEPTEMBER 10TH, 1892.

SALUTATORY.

We make our bow. What do you think of it?

It has been the wonder of thousands of foundrymen that the most important department of the world's most important industry—the iron industry—has never boasted a publication strictly its own. All others are more or less ably looked after by members of periodicals and trade journals, many of which possess much literary merit, are eagerly sought for, and enjoy a high degree of prosperity, but for some strange and unaccountable reason the foundry business has not even been in the rear of the procession, but out of it altogether.

The subject of a foundry paper is not a new idea. The attempt to supply the need is, but although always desirable, we have been the recipients of such assurances of support and encouragement from all over the country since it has become known that we contemplated this step as have surprised us beyond measure, and demonstrated more completely than anything else could at this time, the existence of a universal demand for a paper whose sole object would be the advancement of the foundry interests and all connected therewith. We have come to stay. THE FOUNDRY is a winner, and will, it is hoped, add one more to the already long list of prosperous trade publications for which America is noted. It proposes to become indispensable to every foundry proprietor, superintendent and foreman in the country who is desirous of keeping posted on current events, and to note the improvements constantly being made on present methods. The ambitious molder will see that it reaches his home regularly, and is carefully preserved for future reference. News items from all parts of America will receive particular notice, while mechanical articles by the best writers will be given the attention so necessary for a publication of this kind, and as time goes on new features will be added, until nothing will be left to be desired.

THE FOUNDRY will stand squarely for what, in its opinion, are the best interests of the whole business. No section thereof will be overlooked, and the importance of none unduly magnified.

We ask the co-operation of all those who desire the advancement of the foundry interests. We do not propose to be easily satisfied. Constant improvement we are in a position to promise already, until no paper of its kind in this or any other country shall take higher rank.

MORE LIGHT NEEDED.

There is not a subject which gives the average foreman more cause for anxiety, or which furnishes him with more trouble from his employers, than the selecting of suitable grades of pig iron, scrap, etc., and their proper mixing for special kinds of work. In a heat where the iron is all melted from one cupola, and where the foreman is compelled to melt iron suitable for a large order of pattern work castings—such as a bed for a printing press (which must finish on the face absolutely without flaw or fault), the loss of even a gun's length later a Tea hammer dies or castings for a chemical works, he has to exercise all his ingenuity if he desires to obtain even good results. But few foremen are ever given the opportunity to become experienced on the iron mixtures involved in the turning out of a varied class of work until they find themselves face to face with the problem when the new job is in the sand, etc

THE FOUNDRY. 17

The great trouble lies in a great number of brands of pig iron with which the market is flooded, and the need of standard grades and terms which should be applied to them in all parts of the country so that a certain term applied to Lake Superior irons would indicate the same, or almost exactly the same, as when that term was applied to an Ohio, Pennsylvania or Alabama iron.

If standard grades could be universally used, as in grading wheat for instance, standard methods and mixtures could be adopted and standard rules inaugurated for the guidance of men, but very few of whom have had educational opportunities in youth, and are compelled to rely for much of their information on some pig iron agent, whose only idea is to sell his goods, and who perhaps knows less of the subject than the men he tries to sell to, repeating like a parrot what he has been instructed to say.

We hope to do what we can in our humble way from time to time to remove the cloud of ignorance surrounding this most important subject, to the end that our readers may become as well informed on this subject as a printed article will permit, not losing sight of the fact that shop experience and tests are almost absolutely necessary to a perfect understanding of the subject.

TARDY RECOGNITION.

At no period in the history of the foundry business in America have so many new foundries been completed as during the past twelve months, while many more are now in course of erection. There is one peculiar feature observable in nearly all instances—that while, a few years ago, any sort of a building, with rude and awkward appliances, was good enough for the foundry, it is now considered almost imperative to secure everything of the most modern description. Foundries are planned to provide plenty of light and ventilation, every care being taken to ensure ease of handling and shipment of both the raw material and manufactured article, improved cupolas, electric cranes, the very latest thing in blowers, tumbling barrels, core ovens, etc., are all now considered necessary, while many establishments have gone a step further, and provided commodious washrooms, closets, etc., fitted with all modern conveniences.

While this is only as it should be, yet to the thinking man it indicates several things. In the first place, the importance of the foundry business, and the fact that so much skill is required for its successful management and to prevent waste is now conceded, a desire to make the shop as pleasant as possible to the molders and foundry help is apparent, with the view of increasing the output, and a knowledge born of experience seems to have suddenly made itself felt to the effect that makeshifts no longer pay, as in no other department of the iron industry can money be so readily saved in proportion to the capital needed as in the foundry by utilizing the latest improvements.

PAST IT ALONG.

This is but the initial number of what is destined to be a great trade paper. Those who are at the head have had the experience and possess the necessary capital, and are so far masters of the situation as to place that question among the certainties.

But there are various degrees of success, and in order that we may have the very highest it is desired and expected that every foundryman who receives a sample copy will not only subscribe for it himself, but pass it to others in the same business, with a view to getting them to do likewise. If you are an employer, PLEASE draw the attention of your foreman to it, and the positive benefit he is certain to derive from having it mailed to him from month to month. See to it that every molder in your employment has his attention drawn to it, and remember that by urging him and aiding him to become a subscriber you will be benefiting him and possibly yourself.

To every foundry foreman we would say that it will be our aim to furnish everything that is new and best in shop management from time to time, and to the reading and thinking molder we promise more that will interest him than he can receive from any other source.

Therefore, that we may be warranted in spending no expense to constantly enlarge, improve and render more interesting these columns, we ask your influence, confident that we will receive it and that you will not regret giving it.

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MANUFACTURERS OF

FOUNDRY FACINGS

AND BLACKINGS

Iron, Steel and Brass Foundries. Finest Heavy Stove Plate

Foundry Supplies and Equipments. Return Facings in the United States.

SHIPPERS OF ALL KINDS OF MOLDING SANDS CUPOLA BRICK AND FIRE CLAY.

DEALERS IN East India Plumbago. India Silver Lead.

AGENTS FOR "Whiting," "Colliau," and "Bleakney" Cupolas.

No Charge for Samples of Facings. Write us for Quotations.

REPRODUCTION OF THE FRONT COVER, EDITORIAL AND ADVERTISING PAGES OF THE FIRST ISSUE OF THE F ALSO MARKET AND FOUND ON PA

Made Its Bow 25 Years Ago

With a Few Sidelights on Its Early Struggles and Discuss the Progress Made in a Quarter Century

By John A Penton

Giving various reasons.

One said, "not a sufficiently important industry to support a paper."

Another, "not enough readers."

Still another, "no future to advertising in a foundry paper."

"No one interested in foundry matters will read it."

"No one reads anything about foundry subjects."

"Foundrymen do not read anyhow."

But in spite of all this adverse judgment, I decided to go ahead.

I found then, and have found often since,

That the superficial opinion of the uninformed or impractical was, is and always is liable to be in error.

In the beginning there were only one or two men who had written anything on foundry subjects.

These were Thos. D. West, Simpson Bolland and Robert E. Masters.

All of these I knew very well and intimately.

The first two have passed out of this life,

And Mr. Masters is, I think, living in the south.

They did not, however, write for THE FOUNDRY.

It was not of sufficient importance.

And their contributions, almost exclusively, were sent to *The American Machinist*,

Which in those days was the only publication that considered foundry practice.

But gradually THE FOUNDRY increased in size, reputation, character and influence

And attracted to itself the best literary ability of the country.

For many years it has covered every branch of the foundry industry, not only practically, but energetically, and with much initiative.

From the beginning, of course, we had many strange experiences,

Largely connected with our effort to keep going on little or no capital, credit or anything else,

But a first class, unlimited supply of high grade, thirty-third degree nerve and self-confidence.

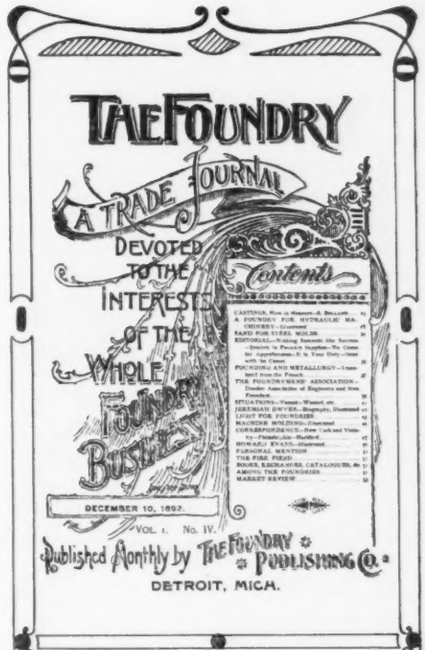
Incidentally, we might mention, that that was the main backing of THE FOUNDRY from the beginning and was its chief asset for many years.

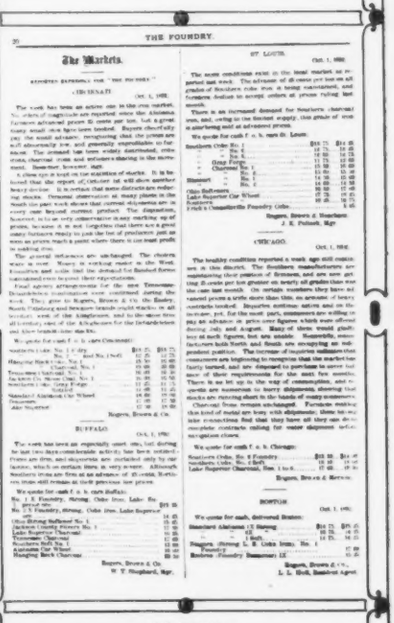
A recital of some of our experiences might make interesting reading, but they largely concern the writer and, hence, with some degree of modesty, can be omitted.

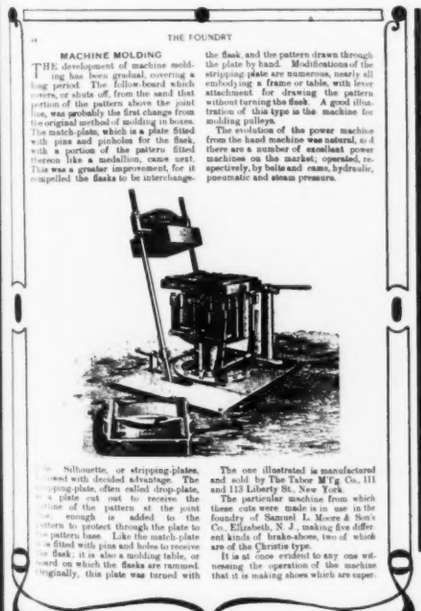
But the outstanding factor contributing to the success of THE FOUNDRY

Has been the peculiar personal loyalty of its readers and advertisers,

From the very beginning and in all parts of the world.







THE development of machine molding has been gradual, covering a long period. The follow-board which covers, or shuts off, from the sand that portion of the pattern above the joint line, was probably the first change from the original method of molding in boxes. The match-plate, which is a plate fitted with pins and pinholes for the flask, with a portion of the pattern fitted thereon like a medallion, came next. This was a greater improvement, for it compelled the flasks to be interchangeable.

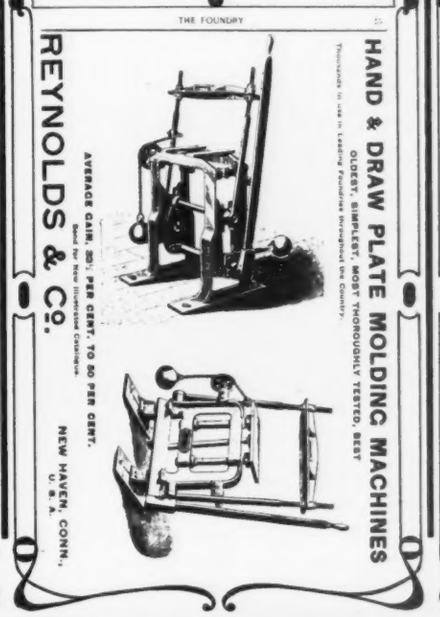
The Silhouette, or stripping-plates, followed with decided advantage. The stripping-plate, often called drop-plate, is a plate cut out to receive the outline of the pattern at the joint line, enough is added to the pattern to protect through the plate to the pattern base. Like the match-plate it is fitted with pins and holes to receive the flask; it is also a molding table, or board on which the flasks are rammed. Originally, this plate was turned with the flask, and the pattern drawn through the plate by hand. Modifications of the stripping plate are numerous, nearly all embodying a frame or table, with lever attachment for drawing the pattern without turning the flask. A good illustration of this type is the machine for molding pulleys.

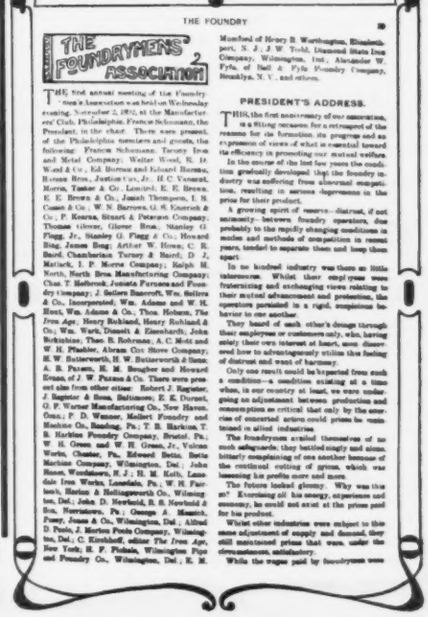
The evolution of the power machine from the hand machine was natural, and there are a number of excellent power machines on the market; operated, respectively, by belts and cams, hydraulic, pneumatic and steam pressure.

The one illustrated is manufactured and sold by The Tabor M'f'g Co., 111 and 113 Liberty St., New York.

The particular machine from which these cuts were made is in use in the foundry of Samuel L. Moore & Son's Co., Elizabeth, N. J., making five different kinds of brake-shoes, two of which are of the Christie type.

It is at once evident to any one witnessing the operation of the machine that it is making shoes which are super-


THE FOUNDRY
REYNOLDS & Co.
AVERAGE GAIN, 20% PER CENT. TO 50 PER CENT.
NEW HAVEN, CONN., U. S. A.
HAND & DRAW PLATE MOLDING MACHINES
OLDEST, SIMPLEST, MOST THOROUGHLY TESTED, BEST



THE FOUNDRY ALSO THE FIRST MOLDING MACHINE DESCRIPTION AND ADVERTISEMENT, FRONT COVER, DECEMBER, 1892; FOUNDRY ON PAGES

It is not unusual, even now, for a subscriber to notify us that he has every issue from the very beginning,

Never having missed reading a single copy.

Speaking of all parts of the world reminds us

That right now our foreign circulation, even in these war-disturbed times,

Is in excess of the entire paid circulation, as I remember it, during the first two or three years of our existence.

In this list England ranks first, Canada second, Japan third, Australia fourth, Scotland fifth, France sixth, Russia seventh, New Zealand eighth, Sweden ninth and

With the following in their order: Italy, Spain, India, Holland, Norway, Switzerland, Argentine, China, Ireland, Denmark, British South Africa, Finland, Peru, Chile, Brazil, Tasmania, Dutch East Indies, Federated Malay States, Greece and Transvaal.

It will be noted that the Philippines, Alaska, Panama, etc., are not counted as being foreign countries.

And before the war, Germany, Austria-Hungary and even Turkey received a good many copies each month.

With some modesty it can be stated that the circulation today averages more than one copy to every iron, steel and malleable iron foundry in America.

Probably no other publication on earth so thoroughly saturates its field from a circulation standpoint.

I secured my first advertisement from Simon Obermayer, president of the S. Obermayer Co., Cincinnati.

I had a hard time seeing him as he sent out word that he was not interested in advertising.

But the bright-eyed office boy, whose acquaintance I made, helped me and I was so persistent and enthusiastic, that Mr. Obermayer gave me an advertisement

And the S. Obermayer Co. has had an advertisement in each issue since that bright day in 1892.

The office boy was the late Harry Frohman, who subsequently became the president of the company upon the death of Mr. Obermayer.

I think I had the friendship of both of these gentlemen until they passed away.

J. H. Whiting, of the Detroit Foundry Equipment Co., now the Whiting Foundry Equipment Co., gave me my second advertisement;

Thos. P. Byram of Byram & Co., Detroit, my third,

And others in their order are the J. D. Smith Foundry Supply Co., J. W. Paxson & Co., Huyett & Smith Mfg. Co., now the American Blower Co.; B. F. Sturtevant Co., Hamilton Facing Mills Co., Ltd., Buffalo Forge Co., W. A. Jones Foundry, Garden City Sand Co., Huessman Crucible Co., Columbia Brass Foundry, Chicago Foundry Supply Co. and Frederic B. Stevens, Detroit.

The second issue did not have quite as many advertising pages as the first—

The third even less,

But with the fourth, the experimental stage seemed to have passed and the increase set in that has been maintained ever since.

Incidentally, as proof that advertising pays, it can be stated that with only a few exceptions the advertisers in our first issue have been with us ever since and have grown and prospered,

As all our readers know.

THE FOUNDRY has had for its editors during the years of vicissitudes, Alexander Cairns, E. H. Pullman, Henry Hansen, Henry M. Lane and A. O. Backert.

Messrs. Cairns and Hansen have passed away

While A. O. Backert, while in charge of the editorial department has made a name and place for himself in many other directions.

Altogether, I believe that this publication has been the most vital factor in the wonderful transformation of the foundry business in the past quarter century.

From being an industry that was studied less, was the least efficient with the smallest and most inferior quality and quantity of labor-saving devices, where there was the most waste and the smallest general knowledge of the problems to be met each day from the buying of the sand to the mixing, melting and testing of the iron,

Of any established American industry—

None has developed more,

None has improved its processes more, and

None has accomplished more, considering the unscientific character of its operations in the early days.

But while the passing of time has made the changes necessary,

THE FOUNDRY was the constant inspiration of it all.

Its publication has brought me many friends.

Its influence for the best practice, high ideals and modern methods has been felt in every corner of the world

And the working out of it all has been the result of an iron molder's determination

To do something better.

THE FOUNDRY Parallels Iron Industry's Progress

By A O Backert

CONCURRENT with the period of the country's greatest industrial growth has been THE FOUNDRY'S quarter of a century of existence. When the first copy of this publication made its appearance in September, 1892, pig iron was being produced at the rate of 9,157,000 tons annually as compared with nearly 40,000,000 tons today. The total steel output was less than 5,000,000 tons, against 42,773,680 tons last year, and iron ore was being brought down at the rate of 6,660,734 tons, whereas this year the shipments from the Lake Superior region will total nearly 60,000,000 tons. Unfortunately, no statistics are available of the extent of the foundry industry in the early 90's, but it can be assumed that its growth has paralleled that of iron and steel manufacture and thus today the casting production is five or six times that of 1892.

Labor-Saving Machinery Effects Economies

In the last 25 years the greatest strides in foundry operations must be credited to the labor-saving machinery introduced. Foremost of this equipment is the molding machine which has made possible the wonderful expansion of this industry. Elevating and conveying devices kept pace with the needs of these plants until today much of the arduous labor involved in mold-making and pouring has been eliminated. The chemistry of the business also has made wonderful progress, and while the most notable discoveries do not fall within the span of the last 25 years, nevertheless, this period marks their adoption and widespread application. From the purchase of pig iron by fracture and brand, the chasm to chemical analysis has been spanned and the physical properties of the foundry product today are of as much importance as the exterior appearance and conformity to pattern. Conservation of materials likewise has made headway, the

cinder mill having been the means of recovering hundreds of thousands of dollars worth of metal for foundrymen. The most advanced step in the cleaning of castings is represented by the sand-blast, which, in its various forms of application, not only effects great economies, but also surfaces the foundry output in a manner unobtainable before its introduction.

Every branch of the foundry industry has benefited from the development of the molding machine and perhaps the greatest progress toward the perfection of the various types has been recorded in the last 15 years. Although mechanical molding devices have been known for more than 100 years, it was not until the last generation that molding machine manufacturers applied themselves diligently to the solving of this great problem that marked progress was made. The jar-ramming principle was known before THE FOUNDRY was established, and although the first machine built by Charles Herman was crude, nevertheless it embodied the principle of packing the sand by the jarring principle. James Reynolds, Harris Tabor, Henry E. Pridmore, Wilfred Lewis, Charles Herman and E. H. Mumford were the pioneers who visualized the possibilities of labor-saving in foundry operations by the application of the molding machine, and to them the industry owes a debt of gratitude. Of this pioneer group, Wilfred Lewis, of Philadelphia, is the only one living.

Steel Casting Progress

Steel casting manufacture has undergone wonderful changes in a quarter century. In the early 90's the crucible process was at its height and feeble attempts were being made to increase output by the acid open-hearth. Basic practice followed in sections of the country where the raw materials for acid castings were high in cost and difficult to obtain, until today the tonnage of basic far outstrips that of the acid open-hearth. The side-blown converter, which possessed advantages in the production of small sections, not credited to the other processes, followed next and the output by this method now greatly exceeds that melted and poured from crucibles.

Introduced in the last decade, the electric furnace has made wonderful strides and the tonnage credited to this process in 1916 was nearly five times greater than that of the crucible shops. Electric furnace development is still in its infancy and its application to every foundry melting and refining process is predicted for the future. In the gray iron foundry, the cupola still is the most economical melting medium. Oil, introduced with coke, represents the latest step in the saving of fuel. The capacity of the cupola, however, has been greatly increased, until today those employed in pipe and car wheel shops, as well as for continuous operations, approach the blast furnace in size.

In the brass foundry many different types of furnaces have been introduced using coke, oil and gas for fuel. Some of these are operated successfully without crucibles, while others are designed to eliminate coke for fuel and still retain the graphite pot. The influence of the electric furnace already is being felt and several of this type already are in successful operation in brass foundries. The chemistry of alloying is better understood today than at any time in the last quarter century and in this branch of the practice great strides are promised in the next few years.

Malleable Casting Manufacture

The metallurgist and chemist have had a wonderful influence on malleable casting manufacture, with the result of greatly increasing the strength, elongation and application of this material. With the possible exception of capacity and method of operation, the air furnace has not changed in 25 years, and while the open-hearth is employed to a limited extent, its advantages evidently are not widely appreciated.

When THE FOUNDRY made its initial bow it announced that it was a "technical journal devoted to the foundry interests" and it has never departed from its original purpose. The corporation that established this publication was known as the Foundry Publishing Co., located at 172 Griswold street, Detroit, of which J. M. McFarland was president; S. E. Whitney, vice president and John A. Penton, secretary-treasurer. The first number contained 36 pages, of which 13½ were paid advertising, 20½ text and the remainder were devoted to the sale of books and announcements regarding the purposes of this publication.

The advertisers in the first issue consisted of the following concerns: S. Obermayer Co., Cincinnati, front cover; J. D. Smith Foundry Supply Co., Cincinnati, inside front cover; J. W. Paxson & Co., Philadelphia; Detroit Foundry Equipment Co., Detroit; Huyett & Smith Mfg. Co., Detroit; B. F. Sturtevant Co., Boston; Hamilton Facing Mill Co., Hamilton, Ont.; Buffalo Forge Co., Buffalo; W. A. Jones, Chicago; Garden City Sand Co., Chicago; Hussman Crucible Co., St. Louis; Columbia Brass Foundry, Chicago; Chicago Foundry Supply Co., Chicago; Frederic B. Stevens, Detroit, inside back cover, and Byram & Co., Detroit, outside back cover.

Among the foregoing whose advertisements have appeared without interruption since the first number, are the following: S. Obermayer Co., J. W. Paxson Co., Detroit Foundry Equipment Co., now the Whiting Foundry Equipment Co. and Frederic B. Stevens. This honor roll was added to in November, 1892, by Craig Ridgway & Son, Coatesville, Pa., and the Joseph Dixon Crucible Co., Jersey City, N. J. In December of the same year the Whitehead Bros. Co., New York, took the plunge in foundry publicity and has advertised continuously since that time.

The leading article in the first issue was written by Simpson Bolland and was entitled "Foundry Ovens". John Pettigew discused "Early Day of the Steel Foundry" and the consolidation of two foundry supply houses, located in Philadelphia, also was announced in this number. The firm of J. A. Emerick & Co., manufacturers of foundry supplies and equipment, of which John A. Emerick and Howard Evans, of J. W. Paxson & Co., were the sole owners, disposed of its business to J. W. Paxson & Co. Mr. Emerick retired from business while Howard Evans joined the Paxson forces, with which he is still connected.

The first reference to semi-steel is contained in the October, 1892, number of THE FOUNDRY, in which announcement is made of the manufacture of this material by the South Chicago Foundry Co. It was described as "a mixture with more than double the strength of the best gray iron" and that "while semi-steel is not a substitute for malleable iron, it is now in general use as a substitute for steel castings in all kinds of cars, crankshafts, rocker arms, crossheads, etc. Being of very fine texture and anti-acid in its properties, it is advantageously used in such work as smelting kettles, acid pans, etc." The claims made for this material at that time seemed to have been without limit, but its substitution for steel castings hardly would be recommended by the most ardent admirers of semisteel today.

Advance of the Steel Casting

In November, 1892, editorial reference was made to the growing use of steel castings and John Walker, of the Walker Mfg. Co., Cleveland, which plant now is owned by the Westinghouse Electric & Mfg. Co., ventured the following opinion regarding the growth of the steel casting industry: "Steel castings are taking the place of ordinary castings and forgings in a great many instances, especially in guns and gun carriage works, marine engine framing and bed plates, stakes for hydraulic riveters, large gears for cable railroad machinery, framing for hydraulic presses, punches, etc."

The first extensive foundry plant description appeared in the December number, the subject of this article having been the works of Henry R. Worthington, Elizabethport, N. J. E. H. Mum-

ford was superintendent of this plant which was one of the largest shops in the country. This issue of THE FOUNDRY likewise recorded a marked increase in size with a total of 68 pages, as compared with 36 in the previous numbers. Among the new advertisers in this issue who have continuously appeared in THE FOUNDRY, is the J. S. McCormick Co., Pittsburgh.

This number also contained the first reference to molding machines in an illustrated article devoted to a power-operated, combination squeezer and stripping-plate. The piston was actuated by steam, although it was stated that either water or compressed air could be employed. The machine was manufactured by the Tabor Mfg. Co., Liberty street, New York, which has been succeeded by the Tabor Mfg. Co., Philadelphia. Machines of the squeezer type first were advertised by the James Reynolds Mfg. Co., New Haven, Conn., whose announcement was the first molding machine advertisement to appear in THE FOUNDRY.

Keep's Test

The first reference to Keep's test for cast iron was made in January, 1893, in an illustrated article written by W. J. Keep of Detroit. The first reference to the Teetor molding machine, manufactured by the Teetor Molding Machine Co., Indianapolis, was made in February, 1893. This machine lowered the mold away from the pattern and was mounted on wheels to facilitate its movement along the floor. An exhaust tumbling barrel was first described in March, 1893, in the advertisement of the Stover Mfg. Co., Freeport, Ill. This barrel was egg-shaped and was provided with an exhaust outlet at one end. The first power-driven sand sifter was referred to in April, 1893, this article having described a machine invented by John Walker of the Walker Mfg. Co., Cleveland.

The wonderful progress of the foundry industry was recorded from month to month in the advertising and reading pages of this publication, and the 300 numbers, of which this is No. 301, constitute a history of the casting art that reflects periodical development.

Gray Iron Progress in 25 Years

By W J Keep

TO GET a correct viewpoint for the beginning of this period we must go back about seven years. At that time the old eastern anthracite furnaces ran slow and with the same ore mixture all of the time. The manager lived close to the furnace so that he could be called any time a change was noticed in the slag, or in the action of the stack. The quality of the iron produced never was expected to change, giving a reputation to this *brand* of pig iron. Such brands as *Crown-Point, Hudson, Poukeepsie, Clove, Crane, Thomas and Bushong* were among the standard eastern foundry irons made in Nos. 1, 2 and 3 grades.

Peculiarities of Brands

Each brand had a peculiarity of its own. Each founder had a mixture that suited his purpose and never changed. He used imported Scotch to enable him to carry scrap. The western coke furnaces, as a rule, did not acquire the reputation for individual brands that was enjoyed by the eastern furnaces. The hard Lake Superior ores did not make as good foundry iron as those mined in the east, even when mixed with soft, local ores. Western furnaces were accustomed to make *Mill, Bessemer, Malleable and Foundry* irons in the same furnace and when a change was made there were several days in which *off* irons were produced.

Soft lake ores soon were discovered which made as good foundry iron as any of the eastern ores. The great red fossil ore deposits of the south, mixed with brown ores near at hand, produced the best foundry iron that had ever been made, and the furnaces ran regularly so that the brands always were dependable. Western founders used *Ohio Softeners* as a scrap carrier, which were more effective than Scotch pig.

W. J. KEEP

No one could tell why one iron was better than another. All pig iron was sold on its reputation and fracture. I once asked the most successful founder in the east for the secret of his iron mixing. He said that the makers of the brands of iron that he used knew what he wanted and set aside piles of such iron. About twice each year he would visit the furnace yards and have several pigs from each pile broken and would mark for shipment the piles that suited him. He said that he knew what would make good castings, but could give no reason for it. Another great iron master and foundryman said that when he was about to make a large casting he selected from his iron yard about three times as much pig as he would use, of the different grades, and melted each grade separately in a cupola and cast it in a regular pig bed. Each pig was then broken and he selected the iron that seemed to him to be suitable for the casting.

The usual foundry troubles were hard spots, chilled edges, blow-holes and shrinkage cracks. These were ascribed by furnace managers and chemists to silica (glass) and to sulphur. The manager of the largest marine engine shop in Cleveland said of his foundry foreman: "I would call Mr. Blank out and tell him about those hard castings, and complain about them." "Well," he would reply, "It is the confounded sulphur in the last lot of coke we got." Fluorspar and patent fluxes were used to counteract these evils. Many founders sold their remelt, and I knew of one stove foundry that accumulated in one year 400 tons of remelt which, it was believed, could not be used.

Effect of Silicon Learned

In 1885 Prof. Thomas Turner, of England, discovered that by varying silicon the grayness and hardness of a casting could be changed at will. Later, in the same year, I discovered that the measure of shrinkage of a test bar was a *mechanical analysis,* showing whether more or less silicon was needed to keep the shrinkage and silicon uniform. In 1886 Prof. Turner stated, "We are still in need of exact information as to the influence of sulphur, phosphorus, and maganese in cast iron." This research was begun at once in America and the results are recorded in the *Transactions* of the American Institute

of Mining Engineers, 1888, 1889, 1891 and 1893. The testing committee of the American Society of Mechanical Engineers followed with physical results which are recorded in their *Transactions* of 1894, 1895, 1896, 1898, 1900, 1901, 1904, and 1905. The testing committee of the American Foundrymen's Association made many investigations, which likewise are recorded in their *Transactions*.

It took several years for the pig iron makers to learn that silicon was beneficial. As early as 1892 some furnaces were selling iron by an analysis of silicon and sulphur, but when they did so, they refused to be responsible for the fracture or for the results in melting. They held that the founder must take the risk if the fracture was close and irregular, which it was sure to be. The founder, however, was not anxious to purchase iron by analysis and would not yield to this, and insisted on a good fracture. The furnace chemist soon found, that with care, the furnace could be run so regularly as to produce an open fracture for No. 2, with a closer grain as silicon decreased. The furnace salesman of such iron educated the founder in the use of silicon and how to make his mixtures. He also advised him to ask the advice of a chemist and to have his castings analyzed.

Instead of blaming coke for every mistake of the foundry foreman, it was purchased by analysis. The result was that laboratories were located at various points to help the founders.

Analysis Control

Today every furnace analyzes everything that goes into the stack and mixes the ores to produce exactly the irons that founders require, and a card, giving the silicon and sulphur, is sent with each carload of pig iron. The founder, who understands mixing, can purchase any grade of pig, and can mix other irons with it to produce the quality he needs. He is not tied down to any special brands. Iron mixing is now an exact science. The modern pig iron maker is liable to run his large furnaces too fast, not allowing enough time for the absorption of carbon. Silicon controls quality by its action on carbon which should be 3.25 to 3.50 per cent. Machine or chill cast pig is not yet very common in this country, but is nearly universal in Europe. The absence of sand makes a clean cupola. The fracture shows exactly the kind of a casting it will make, as any inequality in grain or tendency to chill will be shown by the fracture. Judging by fracture can return again when all pig is chill cast.

The strength of a casting is not entirely dependent upon its chemical composition, but also upon the physical structure of the grain. Experiment will show which of the available pig irons will increase strength. Pig irons for imparting silicon are made in various parts of Ohio and at some other points, from ore which will produce nothing else. Six per cent silicon is about the lowest made and is the most economical. The founder should always have a car of high silicon iron in his yard to use in an emergency, but it is better to get the silicon in the ordinary pig iron. In melting iron, scrap should be broken as small in size as the pig iron, and charging should be uniform, to make the blast equal through all parts of the charge. Riddle out all dirt so that none shall be charged into the cupola. Every cupola should be slagged and analyses made to ascertain whether the limestone flux contains pyrites.

Progress in Foundry Equipment Manufacture

By J H Whiting

FEW foundrymen realize what wonderful progress has been made during the past quarter century in the design and construction of foundry equipment. In the pioneer days, if a new piece of equipment was needed, the superintendent or foreman asked the patternmaker to produce the model, to have the castings made and to assemble a machine by the aid of a few rough sketches. In the early 90's practically all new equipment was built at home. Today, however, the superintendent reports his requirements to the purchasing engineer, who asks for bids from companies specializing in the particular equipment to be installed.

The Continuous Cupola

As in the past, the foundry must operate daily. The cupola must be ready for tomorrow's heat. All of yesterday's castings must be cleaned and out of the way. This is present and past history. We are now coming to a new era. Instead of a cupola melting eight hours daily, we now are asked to design and build miniature blast furnaces, the bottoms of which are dropped after continuous runs of 120 hours or more. The demand is for continuous rather than daily operation, and the ingenuity of the engineering departments of the equipment builders are taxed to the limit to keep pace with the needs of the industry, which constantly become more exacting. Special cupolas for continuous operation have been developed and more than a score already are in use. Individual outside tuyeres is the principal feature of these designs.

For several years there have been insistent demands for new labor-saving devices. History and present conditions warn us of a labor shortage that will last for years after the end of the war. Labor shortage is accompanied by high wages and plant engineers are seeking to eliminate the human factor wherever possible. The cupola charging machine is one of the most wonderful labor-saving devices that can be introduced in foundries producing 50 or more tons daily. These machines, with proper yard and charging platform layout, will reduce the number of men required from 18 to six. On the present wage basis a saving of 12 men for 300 days per year yields a handsome return on the investment. I have been informed that a certain installation of charging machines paid for itself in wages saved in less than two years.

Considerable progress also has been made in the designs for corebaking equipment. The drawer type oven, now in wide use, was introduced only within the last decade. Its extensive adoption for day baking indicates how it met a practical need.

The First Tumbling Barrels

The first tumbling barrels were crude, home-made affairs, but they have been developed into a first-class machine and might be classed among the machine tools. In many cases tumblers are employed in 24-hour service, which is more severe than that imposed upon any machine tool ever built. Tumbling mills are built in more than a dozen different types to meet the particular needs of the purchaser. In size they range from 18 inches round or square by 3 feet in length, to 84 inches round or square by to 10 to 12 feet in length. A single order has been placed for as many as 60 heavy duty steel plate exhaust tumblers for one foundry.

A forward stride in safeguarding health was marked by the introduction of the cloth screen dust arrester.

Mill room conditions of 25 or 30 years ago would not be tolerated today. The proper cleansing of the air by passing it through a cloth screen arrester is indispensible in the modern foundry and is specified by statute in many states.

Crane equipment, perhaps, has undergone the greatest change and is the most important factor in economical operation. The fully-enclosed, dust-proof construction of conveying machinery with its sensitive control apparatus is a big factor in keeping things moving in the busy foundry. Magnet cranes are used for unloading and handling pig and scrap; bucket cranes for unloading and storing coke and sand, and they also may be used for cutting molding sand; electric travelers for the efficient and quick handling of heavy castings and flasks and jib cranes on the side floors for handling small molds, and in the main bays to relieve the overhead travelers. A jib crane in the core room often will enable the same gang to produce 25 per cent more cores per day than otherwise would be the case. Only general features have been touched upon in this review; to attempt to cover all the details of the long list of equipment on the market today would take many pages. I have endeavored to show that in the foundry equipment business, as in other industries, hit-or-miss methods are being replaced by operations based on careful studies of service requirements and actual results. No doubt the next 25 years will witness even greater progress in castings production.

Malleable Iron Improves in Quality

By Enrique Touceda

PROGRESS recorded in the manufacture of malleable cast iron within the past few years has been such as to cause favorable comment by engineers and manufacturers who use these castings in large quantities on machines where the dependability of each working unit is the first consideration. It is undoubtedly true of the history of every industry, the success of which is dependent upon a knowledge of chemistry and metallurgy, that progress is slow, erratic and practically inconsequential, until the scientific principles involved are well understood by those directing the work. Even with this knowledge as an aid, it is not always an easy task to accomplish, in a commercial manner, all that is desired in the way of uniformity and quality of product, for it is obviously impossible to secure the services of scientists to operate metallurgical apparatus under working conditions, both arduous and trying, while large furnaces cannot be controlled with the exactness and nicety that is possible under laboratory conditions.

Prior to 1914, so far as I am aware, no serious attempt had been made by any body of manufacturers to carry on a systematic investigation of the malleable iron process. During that year some 30 different companies, acting jointly, decided that the time had arrived when it was necessary to fall in line and emulate the example of those who in other branches of manufacture had long since discovered such a policy essential and indispensible to advancement. Thereupon it was decided to establish chemical and physical laboratories and to spare no reasonable expense in securing what scientific data were necessary to hasten the solution of their problems and the improvement of the quality of their product. Briefly, the work undertaken covered the following: A study of the reactions that take place in the air furnace and a determination of the allowable limits of the different constituents in the mixture within which it was possible to obtain a hard iron casting such as would yield a superior

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quality of product, and the influence exerted by the different elements in relation to ductility, toughness and strength; a thorough investigation of the reactions that take place in the annealing oven and the effect of the different constituents on the conversion of the hard iron into the annealed product.

Uniform test bars for tensile and impact test were adopted and everything in this connection standardized in order that the same kind of tests would be conducted at each plant, thereby making possible not only a comparison of the quality of product made at one plant with that made by any or all of the others, but in order also that any customer desiring information as to the uniformity and quality of metal made at any plant would find this information available and obtainable immediately upon request.

Air furnace and annealing oven construction has been studied and improved and apparatus has been installed that makes their operation and control more perfect. In recent years makers of malleable castings have devoted considerable time to the study of the elimination of shrinks in castings of intricate design, or disproportionate sections and that great progress in this direction has been achieved can be vouched for by the fact that not only are many thousands of these castings used yearly in the automobile industry, but the demand for them has steadily increased.

Accompanying the decision to perfect all details of the manufacturing end of their business came the equally important determination to perfect their cost-accounting practice. To this end the services of one of the most experienced accountants in the country was secured, through whose efforts an accurate and dependable cost system has been developed and introduced in each plant. In so far as possible the hazard of chance has been eliminated, and systematization and advancement is a slogan that has been followed faithfully. The foregoing is presented because it carries with it the explanation for the healthy and promising improvement in malleable casting production in the last few years.

Operating a commercial laboratory and being in close touch with many foundries we have had occasion in the past 25 years to make many physical tests of malleable iron. As these test bars varied in section, some

having been round and others square or rectangular, a fair comparison cannot be made with what is being done today. Examining the records of these tests, it is seen that the average ultimate strength falls quite a little under 39,000 pounds, while the elongation scarcely averaged 3.50 per cent. Occasional bars showed a very high strength, but in rare cases was this strength accompanied by what we would consider to be fair ductility as measured by the elongation; in other words, in the days referred to, it was not known how to obtain high strength combined with ductility, failing which, high strength is of but little value. I do not wish to be understood as stating that prior to 1914 there were no malleable iron foundries making an excellent and satisfactory product, but it is true that those that did were comparatively limited in number, so limited, in fact, as to have no influence in altering such averages as I have given. Let us now see what results other investigators have obtained at certain intervals during the period referred to.

Records of Other Investigations

I have a copy of an article written by Prof. P. C. Ricketts, published in Van Nostrand's Engineering Magazine, Vol. XXXII No. 4-20, in which he makes record of numerous tensile tests. In order to economize space I have totaled his tables and furnish their average ultimate strength and elongation only. The first table contains a record of eight bars, a full ¾-inch square in section; the average ultimate strength and elongation is 39,821 pounds and 5.60 per cent, respectively. The second table contains the results of four bars that are a scant ¾-inch square in section; the average ultimate strength and elongation of these is 32,580 pounds and 2.10 per cent, respectively. The third table contains the results of seven bars approximating 1 x ⅜-inch in section, the average ultimate strength and elongation of which are 34,467 pounds and 2.40 per cent, respectively. The fourth table contains the results of nine tensile test bars, a full ½-inch round, the average ultimate strength and elongation amounting to 39,101 pounds and 3.50 per cent, respectively. The fifth table contains the results of 13 bars, a full ¾-inch round, whose average ultimate strength and elongation amount to 34,040 pounds and 1.50 per cent elongation.

I also have in my possession the copy of a thesis of which Francis Blake and Max Miner of Sibley College of Mechanics Arts, Cornell University, are the authors. The introduction to the thesis is as follows:

"This series of tests was made in the hope of obtaining a set of reliable values for the strength of malleable cast iron." They have made a very complete examination covering, as did Professor Ricketts, the determination of the elastic limit, ultimate strength, elongation, reduction of area, modulus of elasticity, etc., but as in the former case I quote merely the ultimate strength and elongation:

The tensile tests were made on four bars which measured a full 1 inch in diameter; the average ultimate strength and elongation is 39,375 pounds and 4.48 per cent, respectively. In this thesis they quote an article descriptive of the malleable iron process written by Dr. W. F. Durand for *Marine Engineering*. I have selected these few sentences from the article quoted, which indicate that the ductility of malleable iron must have been very low in the days in which this article was written: "Attention may be called to the ductility of malleable iron, which is from four to six times that of cast iron though only about one-tenth that of wrought iron."

A glance also at the many specifications introduced in the past will demonstrate the fact that low strength and ductility has been the general thought in connection with the physical properties of malleable iron.

Progress Highly Encouraging

Within the past three years we have made many thousands of tensile and impact tests on bars of uniform dimension as specified by the American Society for Testing Materials in their specifications for malleable iron castings. The results of these tests have all been tabulated and conveniently classified, from which we find that in the year 1915 over 94 per cent of the bars exceeded 40,000 pounds in ultimate strength; in 1916 over 97 per cent and thus far in 1917, over 98 per cent exceeded that figure. In 1915, 51 per cent exceeded 46,000 pounds ultimate; in 1916, 73 per cent and thus far in 1917, 76 per cent exceeded that figure. As a matter of fact, in 1917, almost 20 per cent of the bars exceeded 52,000 pounds ultimate and these had an average elongation in round numbers of 15 per cent. During the past two years we have received a large number of bars whose elongation approximated 20 per cent; a fair number in the vicinity of 24 per cent and one bar had an actual elongation of 27.34 per cent, showing that there are possibilities that research may yet find a way to make a cast product like malleable iron equal in physical properties to such hot-worked material as wrought iron.

A consideration of the foregoing facts surely not only justifies one in stating that great progress has been made in this industry within the past few years, but in predicting that study and thought is bound to continue to make itself felt in the direction of steady and continuous progress.

Progress in Malleable Iron Manufacture

By J P Pero

NO REVIEW of the progress made by the foundry industry in the past 25 years would be complete without giving credit to THE FOUNDRY for the part it played in promoting the wonderful advances recorded. I have watched the growth of THE FOUNDRY from its first issue to the current number and I am convinced that the progress made by this publication accurately reflects the advance in foundry practice in that period. Prior to 1892 a few of the trade journals devoted more or less space to articles on foundry practice, but not until the advent of THE FOUNDRY did we have a trade journal devoted to our interests.

That the field has been well covered is attested to by the wonderful growth of this journal; in fact the interests of the shop and the journal are so closely allied that it is hard to imagine either progressing without the other. In the malleable branch of the industry today we are even more reticent in expressing our ideas in the technical journals than were the gray iron foundrymen 25 years ago. The literature on malleable practice is so limited that it never has had a place in the curriculum of the technical schools. Graduate engineers take up practical work well equipped with a theoretical knowledge of gray iron and steel, but they know nothing about malleable cast iron. Only in the past few years have a sufficient number of papers been presented before the American Foundrymen's Association to justify special sessions for the consideration of this topic ex-

clusively which is done today. Probably the largest malleable castings produced are those used in the construction of freight cars and automobiles. From personal observation I have concluded that not until recent years and until the advent of the highly specialized gray iron foundries built for the production of automobile castings, did the gray iron approach the malleable foundries in their efficiency of molding and coremaking practice. I believe that the early development of the molding machine was fostered by the demands of the malleable industry in the production of castings for agricultural implements.

Advent of the Air Furnace

The substitution of the air furnace for the cupola for melting iron marked a new era in malleable practice. While the introduction of the air furnace antedates this 25-year period, it is well within this span that air furnace practice became general.

Seth Boyden used a small air furnace in his foundry in Newark, N. J., and others of small capacity later were erected, some of them with a capacity of only 1000 pounds. When a capacity of 2 or 3 tons had been reached, it was conceded that this was the limit. In 1880, the late Benjamin J. Walker, of the Erie Malleable Iron Co., Erie, Pa., and A. E. Hammer, of the Malleable Iron Fittings Co., Branford, Conn., concluded that there was practically no limit to the capacity of the air furnace provided the lines and proportions of these small type were retained. Beginning their experiments with a 3-ton furnace, by degrees they enlarged it until they were melting 15 tons per heat. Eventually Mr. Walker built and successfully operated a furnace of this type with a capacity of 40 to 50 tons. These experiments were made with furnaces using natural draft.

In the meantime others had increased the capacities of their furnaces by using forced draft. The improvement in the quality of the metal from the air furnace led to the adoption of this process, until today only a comparatively small tonnage is melted in cupolas.

Chemistry of Malleable Iron

In 1878, Mr. Hammer began an investigation of the chemistry of malleable iron, and to quote his exact words he found he "was in an unknown country". After a year's work on the problem, he discovered that the production of *black-heart* malleable depended upon a certain balance or equilibrium between the carbon, silicon and manganese contents. For a long period the varying percentages of sulphur in his mixtures prevented him from reaching definite conclusions, but eventually he determined upon a chemical analysis of pig iron which, under ordinary conditions in the cupola or air furnace would produce so-called black-heart malleable iron.

Reaumur, the eminent French chemist, in 1872 nearly reached a correct conclusion of the chemistry involved in making malleable, but his deductions were based upon crucible practice.

It is my belief that Mr. Hammer was the first to solve the chemistry of the malleable process. As a result of his research and experiments, and the confidence he had in his determinations, he made experiments in 1879 in charging anthracite and coke irons as substitutes for charcoal iron; he soon learned that he could produce high grade malleable iron with these grades by adhering to well-defined chemical specifications and by melting in an air furnace. Thus we find that mixing and melting malleable iron in a little more than 25 years has advanced from the cupola with its charge of charcoal iron and sprue, to the air furnace and open-hearth with mixtures of coke iron, sprue, malleable and steel scrap.

Nor has the annealing process been overlooked in the progress of the last quarter century. Comparatively few changes have been made in the construction of annealing ovens. The most important of these were made for the purpose of securing a more uniform distribution of heat, with economy in the use of fuel as desirable, but secondary consideration. From the ordinary coal-fired oven, types have been evolved using natural gas, producer gas, pulverized coal and oil for fuel. The adoption of the pyrometer marked the beginning of uniform annealing. This instrument has been of incalculable value, both to the control of the oven temperature and as an aid in determining changes in construction to secure uniform temperatures. For many years mill scale and borings were used for packing material in the annealing pots and in bed ovens, and until a few years ago it was considered necessary to enrich the packing by sprinkling it with a solution of acid or of sal-ammoniac, thus adding oxide.. This packing was highly offensive to the employes of the annealing room and its discontinuance proved pleasing to them. The packing now generally employed consists of the slag skimmed from the metal. It is first put through a cinder mill, the shot iron extracted, and occasionally it is enriched by the addition of mill scale or borings, thus making it a satisfactory packing material.

Malleable Iron Ideal Metal

The nature of malleable cast iron makes it ideal for purposes requiring strength and ductility, while its absolute immunity from crystallization under vibratory or other shocks places it in a class by itself among the ferrous metals. These features, combined with its comparatively low cost, have created an ever-increasing demand for its use in freight car construction, automobiles, agricultural implements, etc., and it is not unreasonable to assume that the progress, both in the manufacture and in the use of malleable iron in the next 25 years will be greater than in the last quarter of a century.

Growth of the Foundry Supply Business

By Frederic B Stevens

TO CLEAN one's memory house, to make more clear and distinctive the mental accumulations of 25 years is not altogether an easy task. It is not unlike looking down from the mountain top when trying to discern each individual mile post, each of importance when on the upward journey, but seemingly inconsequential when reviewing the panorama below. The view carries even beyond the starting point, so it may be more than 25 years that here in the central west, the foundry supply houses most in evidence were the Van Tuyl Facings Mills, and the genial "Tom" Kelly was their traveling missionary; afterwards, and perhaps even during the early part of the last quarter century, there was established the firm of T. P. Kelly & Co., and the senior member of that firm still continued his visits until the time of his death.

Simon Obermayer, of the S. Obermayer Foundry Supply Co., also was a welcome visitor in those days, and among other things, concealed in his capacious coat pockets, and which he displayed to each possible buyer,

was a chamois-skin packet, containing molders' tools, slicks, spoons, etc. After taking a large order he never failed to present the shining array, for Mr. Obermayer despised not the day, nor the sale of small things, which characteristic, doubtless, had much to do with laying so good a foundation for so large and prosperous a business, as is evidenced today by the corporation still bearing his name.

Another necessary item of foundry supplies was Albany molding sand, then apparently controlled by the Whitehead Bros., and it is probable that the name *Albany Sand* was rather more indicative of its source than it now implies, for it now is mined over a wide area, extending as far as Saratoga, N. Y., and in these latter days, implies a kind, or a quality, rather than a locality, for we sometimes hear of *Ohio Albany Sand*. At that time the firm of J. D. Smith & Co., Cincinnati, was an ambitious rival for foundry facing business and comprised J. D. Smith and the Fitzmorris brothers. The senior member's two sons then were clad in knickerbockers and were as much interested in the game of *shinney* as they have since been in the manufacture of foundry supplies. Somewhere in those early days, the winter of discontent seemed to have pervaded the souls of two successful salesmen of the S. Obermayer Co., known to the buying trade as John Hill and Tom Griffith, and that combination of youthful ambition, plus some hard-earned savings, gave birth to the Hill & Griffith Co. John Hill now is head of the Hill-Brunner Foundry Supply Co. and Tom Griffith died

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about a year ago. The Cleveland Facing Mills, too, were in evidence, and George P. Millns was their manager and salesman. Thomas D. West at an earlier date was connected with that corporation, but later he conducted foundries of his own, and until his death was a prolific writer of molders' text books, covering a wide range of foundry practice. I believe that the foundry supply business is largely indebted to Messrs. Obermayer and West, for they really were pioneers and they did much to develop the business.

The growth of the foundry supply business was aided and accelerated in large measure by a then restless young man, once a machinery molder at Houghton, Mich., who had an ambitious desire to part with the sand heap. While publisher of the *Machinery Molders' Journal*, at Detroit, he conceived the idea of a publication devoted exclusively to the foundry trade, for which he contended there was a field since no such journal at that time was in existence. He then interested some of his friends in this project, including a lawyer, an insurance agent, a school teacher and the writer, and so THE FOUNDRY was born with John A. Penton as its editor and publisher. During its youthful career it had its vicissitudes and there were times when the ghost walked—so did the printer—but the indefatigable energy and tireless labor of the Penton brand was back of it all and if the baby edition could be placed beside the present number ocular proof would be presented of just what that energy signifies. Also, if the advertisements in that infant edition could be compared with those in this number one would quickly realize how the foundry supply business, like Topsy, "growed".

How Gray Iron Has "Grown" in 25 Years

By Alexander E Outerbridge Jr

THERE is perhaps no more striking evidence of the progress that has been made in the foundry industry during the past quarter of a century than is shown in the growth in size, circulation and importance of THE FOUNDRY. Starting in a very modest manner 25 years ago, I recall distinctly my surprise, on receiving the initial number, that anyone should have the temerity to begin such an enterprise in view of the fact that there were already several trade papers aiming to cover a wider field in the iron and steel industry that were striving to compete with each other for subscriptions and advertisements from foundries. The obituaries of several of these journals have appeared from time to time, but THE FOUNDRY has flourished and has grown in the arid soil of the foundries, from a weak sapling into a giant tree, spreading out its branches until it now covers every field of the iron, steel and brass foundry industry. The natal year of THE FOUNDRY 1892, was a banner year in the production of pig iron; over nine million tons (9,157,000) were made, being more than three million tons (3,219,839) greater than the average of the four preceding years and more than one million tons (1,194,169) greater than the average of the four succeeding years. Then, in the year 1897, the production of pig iron for the first time approached closer the ten million mark, which was passed by a good margin in the following year, since which time production has increased by leaps and bounds, until now it is more than four times that of 1892.

So much for the total output of crude pig iron in the United States during the past 25 years.

What progress has been made in the manufacture of pig iron into finished material during that time?

First and foremost, of course, comes for consideration *steel* in its various forms, and alloys of steel, some of the more important alloys having been created and developed within the period of time named; but as the request which I have received from the editor of THE FOUNDRY to prepare a brief paper specifies "the progress that has been made in the gray iron industry," I must eliminate all consideration of steel products in this paper and confine myself to gray cast iron.

Twenty-five years ago the doom of one of the most distinctive American cast iron industries was generally pronounced. I refer, of course, to the manufacture of chilled cast iron car wheels.

The advent of the 30-ton car, with its load of over 10,000 pounds on each wheel, taken in connection with the increased speed of trains, was commonly thought to necessitate the retirement

from service of the cast iron wheel on the doublescore of safety and economy and the substitution of the cast or forged wheel. Indeed, for a time, it seemed as though this prognostication would surely come true, but the reverse has happened.

Fifty-ton cars made their appearance some years ago with cast iron wheels having twice the load per wheel of the 30-ton car and the end was not reached! It was recently stated by the president of the Railway Club of Pittsburgh that the chilled iron wheel has not only shown successful performance under half a million 50-ton cars, but has even passed the experimental stage under 70-ton cars. The same authority states that there are 25,000,000 chilled cast iron wheels in service, representing 8,000,000 tons of metal, requiring an annual production of 3,000,000 wheels, or approximately 1,000,000 tons of chilled iron to replace those worn out in the service.

These figures are impressive and indicate that the purely American invention of the chilled cast iron car wheel is still able to more than hold its economic importance in the iron industry of the country. More interesting details might be given on this topic, but the space allotted to this discussion will not permit of further consideration. Passing on to the subject of gray iron for foundry castings we find that great advances have been made all along the line.

ALEXANDER E. OUTERBRIDGE JR.

The composition of pig iron and the relation between its composition and its physical properties have been studied from various angles and the old rule-of-thumb methods of mixing iron have now given place to scientific procedure.

Eliminating *chill* from iron by chemical means has permitted the casting of gray iron which can be readily machined in permanent metal molds. These castings have many peculiar and valuable distinctive properties which castings made in sand molds do not possess, such as increased density, extremely fine grain, increased strength, absence of draw holes or sand pits, etc.

Twenty-five years ago the molding machine was in its infancy and small castings only were attempted; now, large castings weighing thousands of pounds are made on jarring machines with unskilled labor in a fraction of the time required to make the molds by hand and skilled labor. The duplicate castings thus made vary much less in weight than do similar castings made in molds rammed by hand.

Science has stepped into the foundry and has cast out many old superstitions giving new life to the gray iron industry as well as to all other branches of the foundry trade and the future has many improvements in store.

Malleable Foundry's Quarter Century Survey

By Richard Moldenke

THE malleable casting occupies a unique position in the general iron industry. It is useful as such only when produced within a comparatively narrow range of composition, and subjected to high and long continued temperatures chosen equally as careful. But little improvement, therefore, may be expected even in a quarter of a century, and then only in the details of the operating end.

Until comparatively recent times, the malleable foundryman only knew that when he took No. 2 charcoal irons, melted them in crucible, cupola and air furnace to yield hard, white, fracture castings, that these, when heated for nearly a week while packed in an oxidizing medium, would—if kept at red heat for fully three days of that time—result in soft, malleable castings showing a *black-heart*. Today he knows why he has had to do these things and consequently can replace the charcoal irons by cheaper metal, besides avoiding the failures due to variations in the mixture, defective melting practice and annealing in regard to which he was formerly helpless.

The beginning of light in the malleable foundry dates from the knowledge that silicon is the controlling factor of the mixture, and it has taken the past 25 years to implant this fact firmly in the minds of the foundrymen interested. Practically every malleable man knows, therefore, what silicon his mixture must carry to bring out correctly the class of work he makes. Unfortunately, however, the chemistry of iron is not the only thing to consider, as the *physics* of the metal also plays an important part, so that the pig-scrap relation, the melting process and the duration and temperature characteristics of the anneal must also be carefully watched by the producer of malleable castings to insure success.

Developments Summarized

The developments of the past 25 years therefore, may be given in the following: The making of mixtures on a chemical basis and with due regard to the physical condition of the metal required; that is to say, the foundryman will have settled for himself the percentage of pig and scrap he may carry in his mixture, the scrap to consist of definite proportions of the foundry sprues and discounts, steel and malleable scrap. One of the great developments for safety has been in this direction. When the percentage of sprues made is very high—as for instance in extremely small work, where it may go up to 75 per cent and particularly where cupola melting is practiced—the sulphur climbs to unsatisfactory limits. If all the sprues are used it is a question of only a short time when the castings cannot be properly annealed for *black-heart* work and the European *white-heart* material must be aimed for, with all the troubles, defectives and expense this entails. With the advent of chemistry in the foundry, however, it has become possible to watch the sulphur in the daily work for the allowable maximum, and thus hold the mixtures to the right sprue proportion. Formerly it was necessary to periodically sweep the sprues out of the foundry and begin anew with straight No. 2 pig.

Again, the higher the scrap percentage the greater the annealing risk. It seems as if the metal will not properly open up, as it were, to allow the deposition of the *temper-carbon* in small patches scattered among the crystalline iron structure. This also applies to the steel and malleable scrap additions to the mixture, which have a powerful effect on the ability of the metal to anneal and upon its quality when properly receptive to the annealing process. These things, as stated, the foundryman

knows or should know if he has followed the advance in the malleable industry. Therefore, he may sit in his office, lay out the melting program to care for his stock of pig iron on hand, malleable scrap that he must take by way of business exchange, and be absolutely certain that if melted right, the castings will go into the anneal with every chance of coming out as first-class malleable.

Introduction of Chemistry

The introduction of chemistry has achieved another result in the malleable foundry. It is no longer necessary to use expensive charcoal pig iron—though this is still desirable if obtainable at comparatively reasonable figures. The foundryman has learned that the chilling qualities of charcoal and coke irons are identical, everything else being equal. Hence there has been no difficulty in replacing charcoal by well-made coke irons. The *well-made* attribute of coke irons needs a word of explanation. Charcoal irons can be made in the furnace with silicon down to 0.10 per cent and still remain unoxidized to an extent that malleable castings with 0.35 per cent silicon, for which some of this extremely low silicon metal has been used, will be first-class. In the case of coke irons, however, any metal with a silicon below 0.75 per cent is almost certain to be oxidized, to have more sulphur than it should and will be generally weak. Therefore, it has been found necessary to hold the castings above 0.65 per cent in silicon, and to do this without danger from gray fractures in the hard castings, steel must be added to raise the freezing point of the metal and thus give the white fractures required before the pieces go into the anneal.

Since, however, the last 15 years have brought about a considerable change in the malleable casting industry—steel having replaced most of the heavy-sectional work—the low silicons of former times have given way to higher ranges and higher percentages of steel and malleable scrap in the mixture. This introduction of coke irons into the malleable foundry and the requirement that the coke irons used must be of the highest quality, meaning thereby the absence of oxygen and low sulphur, has called for an entirely new grade of iron, namely bessemer malleable. In the early days of coke iron in the malleable shop it was found that bessemer pig with the phosphorus *off* gave good results. In other words, if the maximum of 0.100 per cent phosphorus allowed in acid bessemer practice was exceeded and it could not serve that steel process, the iron could still be used in making malleable castings. It was also found, however, that the malleable castings were only good

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when the iron was normally made, and not a true *off* iron due to furnace troubles. As a result, a great range of ores, just a little too high in phosphorus for steel became available for pig-making, commanding a premium over ordinary foundry irons which carry perhaps three times as much phosphorus. All such bessemer malleable pig irons are well-made *honest* pig irons, or must be so to retain their standing in the malleable trade.

Introduction of Steel and Malleable Scrap

In addition to the change from charcoal to coke irons, the introduction of steel and then malleable scrap into malleable mixtures form a development of the past 25 years. In this direction, however, the old saying that "a little knowledge is a dangerous thing" comes into play. Malleable men who found that adding steel to the mixture gave them castings with better bending qualities, as well as greater strength, followed this line of practice too far with the result that their shrinkage problems were increased also. And not only this situation resulted, but the contraction of the castings became so variable that in the standard specifications in use (another comparatively recent development) the allowance for variation of casting from pattern dimensions had to be increased. This is not a good development.

When the steel scrap addition to the mixture is looked at from another angle, namely the use of up to 60 per cent steel in cupola mixtures, a situation results which is not complimentary to the malleable industry. How often has it happened that in discussing the policy of using so much steel with an enthusiastic foundryman doing this very thing in his own shop, and who wished to prove his faith by sending for his own castings from stock, that the first blow of the hammer has set the pieces flying about? True, good castings can be made that way, but they are *white-heart* in the first place, and run up to 0.20 per cent in sulphur, and the most interesting fact is that the total carbon of the hard casting is over 3 per cent. In other words, such material is unreliable and so far as composition is concerned, is surpassed considerably by air furnace iron with far less scrap steel in the mixture. Only the ordinarily low price of steel scrap is the cause of such hybrid developments. These, as well as the product of short anneal methods either die early, breaking their sponsors financially, or the castings are delivered to some industry which is not exacting in its requirements, or is asleep.

On the other hand, the judicious use of steel and malleable scrap, with the best of melting practice—preferably the use of the open-hearth or electric furnace—has resulted in magnificent material, the tensile strength, elongation, transverse strength and deflection of which comes so near to good steel that the foundryman is tempted to enter fields of work he had better stay away from on general principles. He rarely produces such good material day in and day out without sometimes encountering difficulties.

One of the desirable developments of the past 25 years, which has not been exploited as it should have been, is the use of the open-hearth furnace. Considering the fact that the castings made by this melting process are far cheaper than air furnace work—in fact, almost as cheap as cupola castings and far better—the conservatism of the malleable man is evident. A number of open-hearth malleable plants are operating successfully today, and the disastrous results in one large plant in the early days which made the atrocious mistake of attempting to operate without regenerating the producer gas used as well as the air, should not be held up as a warning to those looking into the matter.

Electric Furnace For Malleables

The latest development, that of the electric furnace, is being watched with considerable interest. Whether the particular application is the best remains to be seen. In general, it should be remembered that no matter what the melting process is, the fact remains that by far the greater portion of heat which has to be imparted to iron is used to bring the metal up to the point of melting, the smaller amount going to the actual melting and superheating. If, therefore, the mixture can be heated up to white heat by comparatively cheap

means—as in a soaking-pit with regeneration of air and gas—and then introduced into the electric furnace for melting and superheating under the more expensive conditions of current consumption, the very best results are bound to follow. This idea, therefore, is commended to the malleable industry as a decided development of the next 25 years.

The development of the malleable foundry as a business has been tremendous, the last quarter century having witnessed the doubling of a production that had been close to 500,000 tons per annum at the beginning of that period. The malleable industry is bound to grow even more, the capacities of today being greatly behind the demand. Only the fear of an uncertain future to follow the great cataclysm of today is hindering new building operations, but eventually these are bound to come, and with them labor-saving machinery to solve this problem also.

With this development in view, a proper understanding of the problems of the malleable foundry should be the basis of the necessary planning. Fundamentally, in both the gray iron and the malleable foundry, melting should be done with as little refining as possible. It is desirable to take from the furnace, as nearly as possible, that which has been put in. If, therefore, some method by which heat is imparted to the charges just short of melting is arranged for, and for such a situation suitable charging machinery can be installed readily, the labor problem is cared for, since the hot, solid metal can be introduced easily into the electric furnace by machine. This furnace will melt, correct sulphur and oxidation troubles, allow additions and generally care for the making of an excellent superheated material ready to go into the molds, and will go into them without the terrific rush of pouring an air furnace heat. The melting end of the malleable foundry would then become similar to the melting department of the steel mill, with all its means for economy and tonnage production. The molding machine should care for the future of the molding floor.

Annealing Practice

In annealing development but little has materialized these last 25 years. The usual number of attempts along lines of short annealing periods, special kinds of packing, high temperature ranges, etc., have been made with the usual disastrous results. Most of these attempts were based upon the teachings of laboratory results on very small samples. The investigators did not seem to realize that the critical temperatures of the laboratory electric furnace necessary to bring about the carbon changes in the metal were much higher than the actual temperatures these castings in the saggers of the annealing oven required when given far more time. In other words, where the laboratory chemist found that a piece of *hard* malleable needed 1550 degrees Fahr. to anneal in his furnace, the works chemist found that the same result would be accomplished at 1350 degrees Fahr. with the continued period of application of daily practice.

With all the developments mentioned as occuring these last 25 years, the fact remains that these have been entirely aolng the lines of establishing the principles underlying the production of malleable castings, and taking advantage of this knowledge to improve and standardize the product. The general process itself has not been changed from what it was at the time of Reaumur for the European malleable, or of Boyden for the *black-heart*. The limits of composition as well as limits of temperature for annealing are too close to allow much variation, for when these are overstepped, the product is no longer the malleable casting.

Supplying the Foundryman for 25 Years

By John Hill

WHEN John A. Penton launched THE FOUNDRY 25 years ago, he obtained expressions of opinion from foundrymen and supply and equipment manufacturers throughout the country, regarding the advisability of starting a publication of this kind. This issue reflects the measure of success it has attained. It has proved helpful to the foundry supply business, since it places the manufacturer in close touch with the foundry trade throughout the world.

Few people realize the importance of the so-called *foundry supply game*. At least 90 per cent of the devices invented to facilitate foundry operations have been introduced into casting plants by the supply man. A number of foundry supply dealers sell molding machines, but all of them handle every line of equipment, with this exception, for the modern casting shop.

Whether or not they get credit for it, the foundry supply manufacturers have saved the foundrymen of this country a great deal of money. Wheat and oil are selling at such high prices that their use is almost prohibitive in foundry plants. Through their ingenuity and resourcefulness, the foundry

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supply men have perfected various substitutes to replace flour, rosin and other raw materials, which today are commanding unusually high prices. As a matter of fact, many of the substitutes represent improvements over the materials which they replace and they are sold at about one-half the cost.

Few foundrymen realize the importance and extent of the seacoal facing industry. At least 400 tons of coal are ground daily for this purpose and when the coal barons advanced the price of coal to unheard of heights, the facing manufacturers sold their product at a price below that quoted for run-of-mine coal. As a matter of fact, the foundry supply manufacturer not only can be considered the benefactor of the foundry industry, but in fact, a philanthropist. He is constantly working in the interest of the industry which he supplies, yet, history does not record the endowment of a college or the *spotting* of a library by any member of a firm engaged in the foundry supply trade.

Before the war, practically all grinders obtained graphite for plumbago facings from the island of Ceylon which enjoyed the reputation of producing the finest materials obtainable for foundry facing purposes. As the result of embargoes, curtailment of shipments and increased freight rates, Ceylon graphite was more than doubled in price and it was up to the foundry supply men to

solve the difficulties which then confronted the foundry trade. With all their resourcefulness they investigated the situation and today they are supplying the trade with plumbago that will make good castings, at practically the same prices asked for facings before the war.

In the early days of the foundry supply trade, the supply salesman was given little consideration. In my long experience as a salesman, it has been my privilege, many times, to cool my heels for hours in the offices of some works, awaiting an audience with the purchasing agent. In one instance, three pig iron salesmen, one coke salesman and an insurance agent were permitted to precede me. These gentlemen could not understand why they had the preference over me and when ushered into the purchasing agent's office, they apologized for preceding me, to which the purchasing agent replied, "he is only a facing salesman, let him wait." Time, however, has brought about many changes and the foundry supply salesman now is welcomed in every foundry.

Many of the foundry supply houses operating at the present time carry extensive stocks which include everything used in the foundry, from a wooden wedge to a cupola. It has been my experience that the foundryman will not anticipate his needs and it is necessary for the foundry supply house to carry immense stocks to take care of his every requirement.

One of the perplexities of the foundry supply business is that practically all of the trouble resulting in casting losses, is blamed on the supply man. As a rule, the difficulty is attributable to poor facings. Most of the supply manufacturers employ chemists who analyze the raw materials and who also supervise the making of the mixtures. In addition, practical men are employed by the foundry supply houses, who have the ability, and who are always willing, to render every assistance to their customers to aid them in securing the production of sound castings.

The foundry supply fraternity has been an important factor in promoting the success of the American Foundrymen's Association and its annual exhibitions. In view of the relation of the foundry supply salesmen to the foundrymen, the casting manufacturers should have emblazoned on the tombstones of everyone of these cheerful trade solicitors, "he was a good fellow."

Progress of Steel Founding in 25 Years

By R A Bull

THE subject named above is much more interesting as a matter for reflection than it is satisfactory to describe in a brief resume. The developments of the industry in the last quarter century have been so great and its attractions for young men are so pronounced, that most of those who are today engaged in making steel castings knew nothing of the art 25 years ago. To summarize every interesting phase of the growth of the business in the period mentioned is beyond the ability of the author of this paper. Nor can he safely attempt to chronicle the most important developments in their proper consecutive order and he will only discuss some of them, sketching briefly a few of their applications.

Progress in Furnace Construction

The extensive use of a basic bottom in open-hearth foundry practice has characterized the last quarter century of progress. The largest steel foundries have been built in that period, and many, being located where material markets warranted their choice of a basic lining, have employed it with great success. This has been made possible largely through the concurrent manufacture and intelligent use of alloys, of which 50 per cent ferrosilicon is the better known, enabling the steelmaker to better deoxidize his metal. Today first grade basic steel castings are made in enormous quantities.

Open-hearth furnace construction has made many advances. The tilting furnace is the most striking modification which came into existence in the period under discussion. It has not, however, realized the hopes of its ingenious originators, and now seemingly has no chance to displace to any great extent, the original stationary type. Roof and port construction, and checker design have experienced much scientific development, following the use of new combustibles, such as fuel oil and powdered coal. The combustion of the last named in the open-hearth is the latest novelty to be introduced, and offers to the investigator greater opportunity for experiment than did fuel oil which was quickly found to be most easily adapted for steel melting, and much superior to producer gas.

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Several types of charging machines have been developed in recent years, resulting in reduced charging periods and heavier production. Coincident with these improvements came better valve construction, automatic devices for signalling and recording the reversals of valves, water-cooled ports and door frames, specially designed pyrometers, rapid analytical methods for the laboratory, and numerous other details whose effect in securing the good results now obtained is important, but a complete summary of which is here unnecessary. The need for them has offered a fertile field to engineers and scientists.

Side-Blown Converter

With the improvement attending open-hearth construction and manipulation have come novel types of melting units, the first of which to be introduced in this country being the side-blown converter for foundry use. Its application soon became quite extensive, when it was seen that the installation was relatively inexpensive and that this vessel was well adapted for intermittent use, the production of very hot metal required for pouring thin sections, and making small quantities of steel of special composition. Several modifications of the first accepted type have had successful campaigns.

From Europe came to us, after the development of the foundry converter, our most novel unit for making steel—the electric furnace—of which arc and induction types have been successfully produced. Whereas previously the engineer and the metallurgist supplemented the knowledge gained by the practical foundryman, now the electrical engineer came to the front to help perfect the

art. The development and introduction of the electric furnace have in the last decade been most interesting. It has superseded many converters and crucible furnaces, despite its high installation and fuel cost. The use in this furnace of the lowest grades of melting stock, and the greater refining possibilities have made it very desirable in some localities for certain classes of work. The electric furnace has attained a permanent status which has not appreciably detracted from the favor in which the open-hearth is still held. The improvements in details of construction are constantly taking place.

A natural result of development in furnace construction has been the better opportunity for making manganese steel and other alloy steel castings which in the past 25 years have been made in increasingly greater quantities, some containing elements unknown in steel in 1892. This has been a specialized and most interesting phase of the growth of the steel foundry industry to which we can here only briefly refer.

Pouring steel in green sand molds has been one of the most important details of foundry practice which came into its own in recent years. The foundries in the middle west must be given the credit for applying this method of steel molding in a large commercial way. It has been of tremendous advantage in overcoming shrinkage troubles, increasing production, and otherwise reducing foundry costs. The practice will make much greater advancement in the future as its advantages become more widely recognized, and as the effect of a small amount of moisture in a mold which is properly vented ceases to be exaggerated. In the last two decades, cast steel bolster and side-frame manufacture has assumed very large proportions which would never have been possible without the use of green sand molds. The railroads have been among the chief consuming beneficiaries.

Molding and Coremaking

Molding and coremaking methods in the steel foundry have made much progress, as in the founding of other metals. Pneumatic and electric jarring machines, pneumatic sand rammers, improved types of stripping and roll-over machines as well as gravity machines, pushers and squeezers have all been tried out in the steel shops, and many of them have been there used with good results. More satisfactory designs of sand mills and sand conveying machinery are constantly being worked out, applicable to steel foundry use. For many years the core room did not keep pace with the progress of the molding floor. Within the last 10 years its development has been very rapid, and has inspired to great activity the ingenuity of those who are perfecting methods for handling and drying cores, which processes are no less important than their economical ramming. With improvement in core room practice has naturally come the greater application of the core itself to molding.

The compounding of materials and the use of by-products to give molding and core sands their adhesive quality has been of very great importance in the last 25 years. It is only within the present decade that the manufacture of dry binders has been conducted by men who, considered as a class, have realized the folly of selling the foundryman cheap and in some cases, useless materials whose function often seemed to be to disguise a high-priced mixture. Steel foundrymen in recent years have learned many pertinent truths about sand binders, and are not easily misled.

Pyrometric control of annealing, pneumatic chipping hammers, the use of gas in burning-off risers and in welding, the employment of the electric arc in the latter operation, the use of grab buckets for cleaning floors, and of lifting magnets for handling melting stock, the development of specialties, devices for safety, equipment for comfort, and methods for the better co-operation of employes, have all attended operations in recent years in steel as in other foundries. Much of this growth was absolutely unheralded 25 years ago. Progress made in steel founding during the past quarter century has been of tremendous extent compared with prior development. It seems safe to predict that the next 25 years will far overshadow what we have attempted here to briefly summarize as a past performance.

Semisteel in the Last Quarter Century

By David McLain

IF John A. Penton, a molder by trade, had not had a vision of great possibilities for a foundry trade paper—if he had not persevered in devoting all his energy to his publication, even at a great personal sacrifice—probably this twenty-fifth anniversary might have been postponed indefinitely.

Oldtimers, the writer included, remember distinctly some of the difficulties that confronted Mr. Penton in the early days, but none were so discouraging as the hardships worked by his own craft. Practical men who had been working at the trade for years thought little could be gained from such a trade paper, as they claimed Mr. Penton was only a molder, not an editor.

But what an example of perseverance is reflected by the twenty-fifth anniversary of this publication! Mr. Penton was right and many others were wrong.

I have been asked to write about semisteel, but at the same time I hope I will be pardoned for reviewing the improvements in metallurgical processes in the iron foundry business during the past 25 years. In fact, to one like the writer who has been on the firing line for more than 40 years, it appears as if there has been 100 years' advancement within the past quarter century.

To the late Thomas D. West the American foundry industry is so greatly indebted that it should erect a monument in his name to commemorate his wonderful achievements. He was *another molder* whose efforts started many foundrymen thinking along the right lines when he published his book entitled *The Metallurgy of Cast Iron.*

The advance in the art would have been still more rapid if some one had written a companion book on "Good Cupola Practice", but evidently this was left severely alone by those competent to melt iron scientifically.

In the early days the ratio of cupola area to tuyere area was not understood, and in many instances the cupola area was 20 to 30 to 1 of the tuyere area, with two, three and four rows of tuyeres; experiments have proven that the best tuyere area, in proportion to the cupola area, is confined within very narrow limits, and *one row of tuyeres is sufficient.*

The coke to iron ratio averaged 6 and 7 to 1, but today from 8 to 10 to 1 on medium heats, and up to 12 to 1 on long heats, is quite common, although the Connellsville coke used in those days was equal to, in fact, superior to, some of the cokes being sold today for much higher prices.

The melter was a law unto himself, as the cupola was but little understood and its workings were considered mysterious; this continued until we learned the proper tuyere area, the exact amount of coke to use on the bed and between the charges for different sized cupolas, the proper amount of iron on the bed, etc. Until we could take down satisfactory heats every day, instead of only *sometimes,* it was practically impossible to melt steel scrap in large quantities

in the production of homogeneous, machinable castings of light section.

Fifteen years ago the writer completed experiments and announced to the Milwaukee Foundrymen's association that a *new metal* was discovered. Since we used about one-third steel and added ferromanganese in the cupola thereby gaining 40 per cent transverse strength over the best grade of gray iron and reduced the casting losses, we called the metal semisteel and have been doing so ever since.

Practical Knowledge a Drawback

How was the announcement received by foundrymen? Like other new ideas, it was considered a *fake*, of course. The writer also was a molder, who worked up through the business to foundry manager, and the word *practical* seemed to stand for *drawback* among the fraternity. All but a few had previously thrown some steel turnings or borings into the ladle of iron or preheated steel scrap or placed it in the bottom of the ladle before tapping; this was called semisteel, but frequently it was of no use whatever, and hence was called something else.

After the writer was through experimenting with semisteel, he had a strong desire to help broaden the practical man's knowledge of better foundry work. He began to teach foundrymen free of charge and did so for many years before offering the information to the trade in the form of a scientifically arranged course of instruction. The first announcement of this course appeared in THE FOUNDRY in 1908, and for some time was looked upon with suspicion by foundrymen; evidently many misconstrued my intentions and were laboring under the impression that I intended to teach *molding* by mail, instead of practical metallurgy, the results of my years of successful experimenting in many shops. They could not conceive how it was possible for a practical foundryman to acquire the necessary knowledge of metallurgy to do this.

Foundrymen did not take kindly to the idea of learning to mix irons by analysis, which they were compelled to do before receiving the semisteel formula, for by this time they believed that all that was necessary was to throw some steel scrap into the cupola and they had semisteel. Of course, not understanding the fundamental principles governing the melting of steel in the cupola, the resultant metal was far from being the *real* semisteel, and hence was condemned.

For many years old Scotch foremen had used steel scrap to make hard or white iron and laughed at our claims for semisteel for thin and medium sections. Today some foundrymen still claim that steel scrap will not improve their product, but the majority of foundrymen know better and every year adds converts to this wonderful metal.

Prior to 1902 the writer can find no record where steel scrap and good foundry pig would reproduce any mixture in which charcoal pig had been thought essential. That one achievement alone marked a milestone in foundry progress and was so considered by the pioneers who had used high carbon charcoal pig iron for years. In fact, they believed they could not operate without it.

At that time all text books, whether by technical or practical men, maintained that steel reduced carbon. Chemists and metallurgists agreed that it was not a good thing to use; that steel would not mix with iron; that steel caused hard spots; that a higher melting temperature was necessary, and that manganese was a hardener because of the

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accepted theory that it converted graphitic carbon to combined carbon, etc.

The use of steel in cupola mixtures was questioned on all sides, but much doubt was set at rest when it was proved that carbon would be absorbed from the fuel by the steel up to the saturation point; that manganese, above a certain point, aided in increasing the saturation point of iron for carbon, since steel fuses perfectly as it has a strong affinity for carbon, silicon, sulphur, phosphorus and manganese, proving to the metallurgical world that steel improved the product and that a new principle was discovered and applied with astonishing results.

The writer does not claim to be the first man to use steel in cupola mixtures, but no previous record has been found relating to the use of large percentages of steel scrap in castings of light section.

When properly made, semisteel, in both temperature and fluidity, exceeds any other mixture melted in the cupola. The oxidation of the steel, when melting scientifically, is scarcely perceptible; when the steel is heated in the presence of the coke it begins to absorb carbon from the fuel, faintly at low temperature, but as the temperature increases and the steel and coke become incandescent, the steel absorbs large percentages of carbon and no longer is the steel of commerce, but a highly carbonized metal and *will melt before the pig iron in the same charge.*

No record could be found of how much manganese should be in the mixtures for certain castings, but our steel foundry experience has taught us that the percentages necessary to produce the best and strongest steel castings, so we began at that point and increased the percentages with surprising results.

At that time the average iron foundryman apparently did not care whether there was manganese in his pig iron, as the claim that manganese was a hardener led foundrymen to believe it was a good thing to leave out of their mixtures.

The writer has produced machinable castings of light section with 30 per cent steel and containing 2.25 per cent manganese. As we have insisted on high manganese pig, and have advised our friends to do likewise, it is now possible to obtain pig iron with from 1 to 4 per cent of manganese.

We also learned that high manganese with high phosphorus pig produced a superior quality plow point when used with 20 to 30 per cent steel scrap, and that steel additions enabled the automobile, gas engine and other cylinder manufacturers to produce better cylinders of lighter sections with lower casting losses.

Within the past decade the stove founder is using waste steel clippings and makes stronger, cleaner castings with lower losses. Steel improves the quality of piano plates, agricultural castings, car wheels, radiators, shrapnel, projectiles, acid, ammonia, furnace, die and general jobbing castings; in fact, steel improves all castings that must be subjected to hydraulic or other tests, or where a certain high transverse or tensile strength is desired. Every conceivable iron casting is improved by steel scrap when used by men who know how to mix by analysis and to melt intelligently.

Increased Transverse Strength

I have increased the transverse strength of soft gray iron for light sections from 2000 to 3000 pounds by the addition of only 10 per cent of steel and have increased the transverse strength of gray iron for heavy castings from 2500 pounds per square inch up to 4000 pounds and more by the addition of 30 to 50 per cent of steel

scrap. This certainly is ample proof. Formerly it was customary to use chills on the V-ways of lathe beds inside of large cylinders, etc., but semisteel of the proper density is preferable and has satisfactorily replaced chills except for car wheels and rolls.

While the foregoing are achievements that have been recorded since THE FOUNDRY. was first published, the majority have taken place within the past 15 years. The writer predicts that in the next five years chromium, nickel, manganese, etc., will be used to produce better semisteel, as I already know that we are on the verge of some interesting metallurgical developments. I look forward to the time when semisteel castings will be made that will yield a tensile strength of 50,000 pounds per square inch without annealing and 65,000 pounds and over when annealed. The reason many foundrymen have not manifested more interest in semisteel is because they do not understand the laws governing the melting of steel in the cupola. When they begin to understand this they will realize that the cupola is the heart of the foundry and every progressive foundryman not only will believe in semisteel, but he will make it and profit greatly thereby in the improved quality of his castings.

What the Brass Foundry Has Done in 25 Years

By Charles Vickers

CONSIDERABLE progress has been made in the brass foundry business during the time that THE FOUNDRY has been on the scene and much of it is traceable directly to the efforts of the founder of this publication, aided and abetted by those who have taken time from sand pounding to let other foundrymen know what was in their minds.

When the last quarter of a century was young, the adoption of means for the comfort, safety and convenience of the employes seldom was considered. Today, however, the ventilation of the plant is of prime important when a new foundry is designed. Formerly the brass foundry was an undesirable place to work in, as gases from the furnaces filled the shop to the great discomfort of the operatives. This condition sometimes was regarded as inseparable from the proper conduct of the business. In one large foundry that melted about 100,000 pounds of metal per day 20 years ago, blast-driven, hard coal-fired furnaces were installed under the same roof as the molding floor. As the furnace flues were inadequate, the gases of combustion were driven in clouds from underneath the furnace covers and filled the shop with fumes. In winter, when the shop windows and sky-lights were closed it was not unusual for the molders to have headaches and some became so sick they could not return to work for several days. While the difficulty in this case was due to poorly designed furnaces, it was aggravated by housing them in a long, narrow, low building, with the furnaces in one end and the molders in the other. The result was that in both winter and summer, the windows and doors had to be kept open to let out the gas. In winter, the employes suffered from the cold and in summer the heat was almost unbearable, due to the low roof. The defect could have been remedied at little cost by enlarging the furnace flues.

In a shop that specialized in phosphor bronze, it was the foolish custom to add the phosphorus to the metal after the pot had been taken from the furnace. Seven pounds of yellow phosphorous were added to each pot of 300 pounds of bronze by the simple expedient of tossing the phosphorus from a water-filled can to the surface of the molten metal, stirring after each addition with a long, iron bar. Two men devoted themselves to this pastime.

It must not be assumed that all brass foundries, even 25 years ago, were poorly ventilated, unsanitary and unsafe. Another foundry of that period, which specialized in plumbers' and steam fitters' brass goods was located in a large, roomy building, with a high roof and had plenty of light and ventilation. Fifty molders and coremakers were employed, the latter girls who were separately housed and were provided with all the conveniences one would expect in a modern foundry. For the men, neither wash rooms nor lockers were provided. Everyone carried the dirt of the foundry into his home.

Wash Rooms and Lockers

In one large city where the molders were well organized they demanded that washing facilities and lockers be installed in the brass foundries. After the surprised employers had recovered from the shock of this request they cheerfully provided washing and locker facilities.

The progress that has been made in improving the working conditions of foundry employes has been worth while as it has proved beneficial to all engaged in the production of castings.

The alloys in the production of which there has been no improvement are those that have been known for centuries, including the copper-tin, copper-zinc and copper-lead series. The alloys in which progress has been recorded are the modern bronzes such as manganese and aluminum bronze, and strides also have been made in the casting of aluminum alloys. We have a greater knowledge of the peculiarities of these alloys, with the result that no great difficulty is now experienced in making castings from them of any required size. If a manganese bronze casting is unsound and requires patching, such as burning-on to cover up the defects, then its life is uncertain and is liable to be terminated at any time by season cracking. The cause of this phenomenon is unknown.

While some measure of progress undoubtedly has been made in the art of brass founding in the past 25 years, candor compels us to admit that it has not been quite as startling as it might have been, considering the attention the business has latterly received in a technical way. Anyone who has visited many brass foundries is impressed with the scrap piles which are still with us. Spongy castings, blown and misplaced cores, washed sand, and parts forgotten, still figure largely as the causes of our unsuccessful efforts to shape metal in sand. Castings still continue to be returned by the purchaser, perhaps because they leak, are too rough or fail to check up with the patterns.

While we have more tools to work with and more *expert* aid than in years gone by, the brass foundry owner is not getting rich any faster than formerly, nor is less skill required by the molder.

Some progress has been made in casting aluminum and copper alloys, but it is not sufficient to attract much attention. A few years ago the casting of manganese bronze was regarded as quite a problem, due to the fact that the alloy possesses what might be termed an *honest* shrinkage. Such a casting, insufficiently fed by metal from some external source, such as a riser, will show shrinkage cavities and depressions on its surface and proving beyond question that it is defective. In the case of the copper-tin alloys, however, while the shrinkage is there just the same, it is concealed and does not show on the surface of the casting. Before the modern bronzes were known, comparatively small risers were used to feed brass castings and it was

FORMULAS FOR THE BRASS FOUNDRYMAN

Aluminum Alloys

One of the most extensively used alloys of aluminum is what is known as No. 12. It consists of aluminum and copper. The usual proportions are copper, 8 per cent and aluminum, 92 per cent, but it is not unusual for the alloy to be softened by reducing the percentage of copper to 7, and sometimes to 6 per cent, the aluminum being increased in proportion to the decrease in the percentage of copper.

The best method of making this alloy is by the use of a hardener composed of equal parts of copper and aluminum, as follows:

	Pounds
Copper	50
Aluminum	50

Melt the copper under a cover of fine charcoal, and when thoroughly liquid, add the aluminum gradually, in small pieces, and between additions, stir with an iron bar coated with alundum cement applied as a wash and afterwards dried. Have the stirrer hot before dipping into the molten metal. Add the aluminum no faster than the copper will dissolve it without being chilled partly solid, and after the addition of all the aluminum, remove immediately from the furnace and pour into ingots. Do not allow the hardener to reach a bright-red heat before removing it from the furnace.

When cold, the hardener will be rather brittle and no difficulty will be experienced in breaking it into pieces suitable for making weights.

To make the 8 per cent aluminum-copper alloy, or regular No. 12 aluminum, melt together the following proportions of hardener and pure aluminum, in a crucible of suitable size:

	Pounds
Pure aluminum	84
Hardener	16

If a softer alloy is required, smaller percentages of hardener may be added.

Great care always must be exercised in making alloys of aluminum if good results are desired. This involves constant supervision throughout the melting process. A bright red heat is always dangerous to aluminum, because being so chemically active, it attacks the materials of which the crucible is made; merely rubbing the sides of the crucible with the stirring rod frequently will start a reaction, the result of which is always harmful to the alloy. The temperature of the metal, therefore, should be kept no higher than a dull red, approximately 800 degrees Cent.

While thin castings require pouring at a temperature of about 800 degrees Cent. in many cases to insure proper running, this is too high for castings of thick section. The latter should be poured no hotter than 700 degrees Cent., and below this temperature if possible. Hot-poured aluminum castings will be porous, as indicated by black spots. At a red heat aluminum greedily absorbs the steam generated by contact with the moist sand, at the same time decomposing it and combines with the oxygen to form alumina which is a white solid. It retains the lively hydrogen in the form of minute bubbles which are disseminated throughout the mass of the casting.

FORMULAS FOR THE BRASS FOUNDRYMAN

Aluminum Alloys

An alloy of aluminum, zinc and copper, employed extensively for automobile work, follows:

	Pounds
Pure aluminum	79
Aluminum hardener	6
Zinc	15

The specific gravity of this alloy is 3.10; the tensile strength is as high as 25,000 pounds per square inch and the casting qualities are good.

The following aluminum alloy also is frequently used:

	Pounds
Pure aluminum	65
Zinc	35

The specific gravity of this alloy is 3.30 and its tensile strength is in excess of 30,000 pounds per square inch.

The following alloy has good casting qualities and possesses about the same tensile strength as the alloy previously named:

	Pounds
Pure aluminum	70
Aluminum hardener	7
Zinc	23

A good, white alloy, suitable for pattern plates, follows:

	Pounds
Pure aluminum	79
Aluminum hardener	4
Tin	2
Zinc	15

Another alloy suitable for the same purpose as the foregoing, follows:

	Pounds
Pure aluminum	80
Aluminum hardener	10
Tin	10

When melting aluminum alloys the pasty dross that occasionally forms on the surface of the metal can be removed by the addition of a small piece of fused zinc chloride. The effect of this chemical is to cause a reaction which effects a separation of the dross and entangled metal, the former being liberated in the form of dust.

THE FOUNDRY DATA SHEET, SEPTEMBER, 1917

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.

natural that the same methods should be applied to manganese bronze before the peculiarities of this alloy became known. Under the name of steel bronze the alloy was used extensively for making sprocket wheels for bicycles and it seems ludicrous now that this trouble should have been experienced in making such simple castings. Truly, we have made progress in this direction in the past few years.

When the light aluminum alloys were first introduced, much difficulty was experienced from the cracking of the castings in the molds. This probably was due to the selection of unsuitable alloys and to the fact that the molds were rammed too hard. Too much zinc also was used in the aluminum alloys with the result that the metal was susceptible to cracking. Large quantities of sprocket wheel and chain guards for bicycles were cast in aluminum, and to prevent cracking, it was the practice to remove the copes before the sprues had solidified and to ease the castings from the sand so that they would be free to contract. The result was not always satisfactory, although it undoubtedly helped.

The copper-tin alloys comprised all of the brass foundry metals that have been melted and cast since the days of Tubal Cain. Those of us who can cover 25 years in retrospect, must be impressed with the fact that while we have progressed so far as quantity is concerned, the same cannot be said of the quality of the castings. Among the world's wonderful castings are the Colossus of Rhodes, the Russian and Chinese bells, and the casting the boys used to make in the saloon on Saturday afternoon. It was so large that one of the molders had to ride around the mold on horseback to light the vents and it was so big that an oil barrel had to be used as a pattern for the riser. So far as ordinary brass and bronze are concerned, it is difficult to note much progress in the last 25 years and this is largely due to the fact that the founding of these alloys, as practiced at present, has been thoroughly understood for centuries.

Weapons of War

During one period, bronze was used extensively in the manufacture of weapons of war, and as a result it received careful study; its properties and peculiarities, even the desirability of rapid cooling, were thoroughly understood. To counteract the harmful effects of slow cooling, heavy cannon were cast with water-cooled cores centrally located. To accomplish this feat without disaster, would tax the resources of most plants today.

With the possible exception of the aluminum alloys, none is so unsuited for casting in sand molds as the copper-tin series, because the heat-conducting power of damp sand is extremely low; the sand, therefore, promotes the slow cooling of the metal, which in turn causes segregation in the constituents of the alloy, resulting in a comparatively weak casting. Copper-tin alloys should be cooled as quickly as possible after the metal has filled the mold, but the surplus metal used for feeding to replace shrinkage, should cool slowly so that it may perform its office to the best advantage.

For important castings, however, a better molding medium than sand should be discovered. Many new refractory substances have been placed at the disposal of the casting industry in recent years by the development of the electric furnace and it seems that an artificial molding medium could be produced that would fulfill, better than sand, the requirements of a mold for these alloys. Such a molding material should conduct heat better than sand; it should make a stronger mold, so that cores could be set without crushing the mold and it should be more refractory than sand.

Molding and Coring a 5-Ton Gear Cutter Bed

(*Continued from Page* 365)

floor. The casting is shown in Fig. 6, just after its removal from the pit, having been rolled over on its side. Fig. 7 is a view of the casting chipped and ready for shipment.

The casting was out of the sand by 10 o'clock Monday morning, and the pit was soaked for the remainder of the day, having been cleaned out by the night gang and was ready for another mold on Tuesday morning.

The hook bolts do not bind on the rod as might be imagined, the heat of the casting causing them to expand until they are at least 5/8-inch away from the bottom of the rod extending through the lugs. The planed surfaces of the lugs make excellent bearings for the body cores. As the frame is never disturbed, it is unnecessary to make a new cinder bed or to level the pit bottom. By night of the first day the pit is ready for the cope and by the evening of the second day it is under fire.

R. J. Doty, who has been in charge of the steel foundry operated by the Isaac Johnson Co., Spuyten Duyvil, N. Y., during the past three years, has resigned to become associated with the Sivyer Steel Casting Co., Milwaukee. The plant of this company is to be considerably enlarged and a 3-ton electric furnace will be installed to provide additional melting capacity.

Welding Institute Established

The Davis-Bournonville Co, Jersey City, N. J., has established a welding institute for the purpose of giving instruction in the oxy-acetylene art. The institute was opened on Aug. 1 and the courses and their cost follow: Instruction for experienced operators, one week, $100; instruction for superintendents, foremen and students of exceptional ability, two weeks, $150; and the general course of instruction, four weeks, $200.

The institute is under the supervision of Henry Cave, technical director for the Davis-Bournonville Co. His assistants not only are engineers of considerable practical experience, but also are instructors who are familiar with the best methods of imparting information.

Pig Iron Production Declined During First Half of Year

According to statistics issued by the American Iron and Steel Institute, the pig iron production during the first half of this year totaled 19,258,235 tons as compared with 19,699,522 tons during the same period last year. This shows a slight decline which must be attributed to the fuel shortage and repairs to furnaces which had to be made on account of the hard driving of these plants for a period of nearly two years. The foundry pig iron and ferrosilicon output declined nearly 500,000 tons, the output for the first half of this year having reached a total of only 2,602,448 tons as compared with 3,086,410 tons for the first half of 1916. On the other hand, the malleable pig iron production showed an increase of nearly 50,000 tons for these respective periods, the output during the first half of this year having been 509,982 tons as compared with 460,839 tons during the same period in 1916.

T. P. Kelly & Co., Inc., New York City, manufacturers of foundry facings and supplies, are adding two new buildings to their large plant at Stockertown, Pa., to take care of their increased volume of business. Additional power and milling machinery is being installed.

Th Western Electric Co., New York, has established three new electrical supply houses, one to serve the trade in Connecticut and adjacent territory, located in New Haven, in charge of Tyler L. Holmes. A warehouse also has been established at Baltimore, in charge of S. Greenfield, and one at Charlotte, N. C., in charge of R. H. Bouligny.

FIG. 1—BEAUTIFUL TREES AND WELL-KEPT LAWNS BORDER THE FOUNDRY BUILDINGS ON THE NORTH
FIG. 2—A NEW DEPARTURE IN DESIGN OF FOUNDRY OFFICES
FIG. 3—ENTRANCE TO WALKER & PRATT MFG. CO.'S PLANT SHOWING EXTERIOR OF SUPERINTENDENT'S OFFICE

Making Cook Stoves for Uncle Sam's New Army

How Far-Sighted Foundry Planning Enabled a New England Manufacturer to Meet an Emergency Order for Cantonment Equipment

By E L Shaner

IN EFFECT, the great war is the inventory taker, organization inspector, efficiency checker and ultimate appraiser of America's industries. For many years manufacturing has progressed or declined, according to the demands of business. The amount of the quarterly dividend in many cases has been the criterion of ability to conduct business effectively. In the period of normal conditions, no opportunity was presented for testing the ability of manufacturers to meet an unforeseen emergency.

War has changed this status of things. Now that the United States has entered the conflict, practically every branch of industry is confronting an exacting test of preparedness. In this baptism of fire, the manufacturers are finding that wise planning when their plants were built, proper management during the growth and development of the business, and farsightedness in perfecting an organization are assets of inestimable value in successfully satisfying war's unusual demands. The advantages of constantly preparing for the future are well illustrated by the experience of the Walker & Pratt Mfg. Co., Boston, now engaged in making cooking ranges for one of the large cantonments under construction for the United States army. That the company was able to undertake the manufacture of this equipment on short notice and without seriously interfering with the production of the usual line of stoves and furnaces, is largely due to a policy of foundry planning adopted nearly 20 years ago when the original buildings of the present plant at Watertown, Mass., were erected. Fig. 5, reproduced from page 194 of the July, 1899, issue of THE FOUNDRY, is a plan of the buildings erected in that year. Fig. 6, taken from page 195 of the same issue of THE FOUNDRY, shows the "probable plan when capacity is doubled". The extreme accuracy with which the men who planned for future extensions, predicted the growth of the business may be judged by comparing the proposed plant, Fig. 6, with Fig. 7, a plan drawing of the buildings as they actually exist today. The policy of expansion adopted nearly 20 years ago was so well suited to the conditions that later developed that the proposed plans were followed in almost every minute detail. The fact that the dimensions of the present warehouse, foundry, pattern storage, and core room exceed those of the proposed plan for a plant of double the original capacity, is further evidence of the care with which the buildings were first laid out.

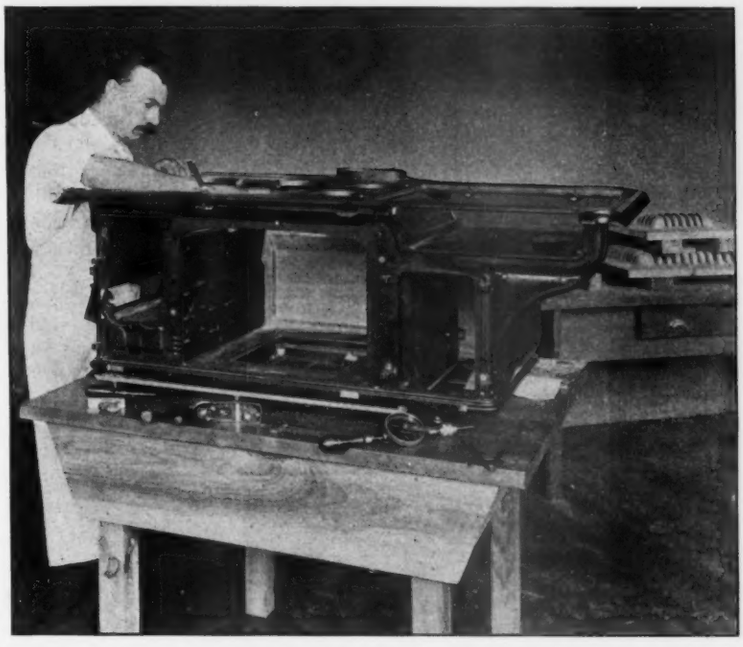


FIG. 4—A MODEL OF THE STOVE IS MADE OF WOOD PATTERNS

The processes involved in casting, fitting and assembling stoves in the plant of the Walker & Pratt Mfg. Co. are the result of experience covering a great many years. Unlike many stove manufacturers, this company has developed its organization to insure sufficient accuracy in making certain castings so that the parts are interchangeable. This feature alone is responsible for the elasticity in shop schedules which has enabled the company to execute large orders with minimum delay and confusion. Stoves whose parts are interchangeable may be shipped in a partly assembled condition, thereby conserving shipping space and minimizing the danger of breakage.

The first step in turning out stoves of the kind built by the Walker & Pratt Mfg. Co., for the army cantonment, consists in making the master patterns of the stove plates from the designer's drawings. The separate patterns are then assembled, forming a complete model of the stove, as illustrated in Fig. 4. In stovemaking, the patternmaker not only must be careful to shape the patterns to meet the conditions imposed by current molding practice, but also must be careful that the patterns admit of easy assembling and dismantling to facilitate the replacement of broken parts. The work in the pattern shop is closely allied to the methods of molding employed in the foundry. This close relationship was emphasized when it became evident that castings must be produced with unusual rappidity to supply the army cook stoves as fast as the government called for them. In the effort to speed-up production it was discovered that by simply altering a number of patterns, work that had been done by hand in the foundry, could be molded on machines. In one instance, an oven door that previously had been molded by hand, was redesigned to be cast in two parts, each of which was easily molded on a hand-operated squeezer machine. In another case, a small lug which had prevented a certain casting from being machine-molded was cast separately, thus permitting the piece to be made on a machine. The independently-cast lug was then

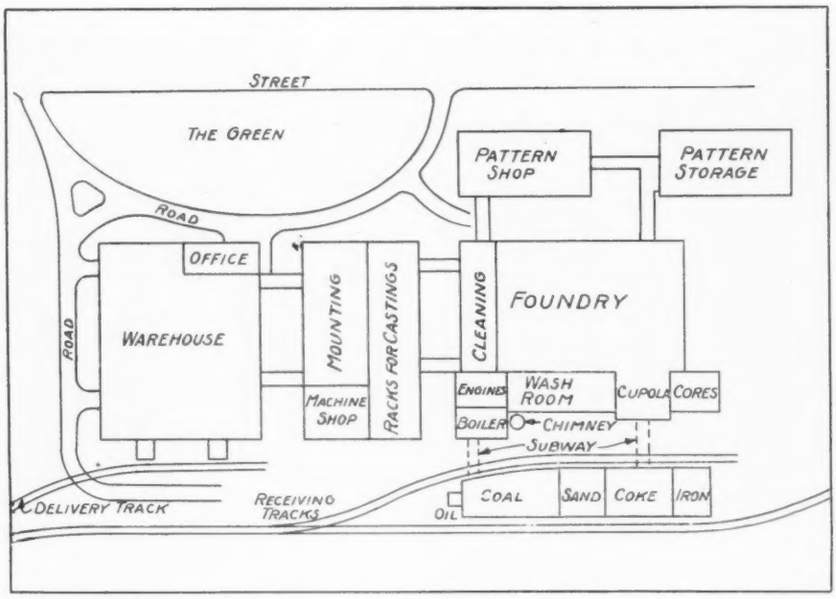


FIG. 5—GENERAL PLAN OF BUILDINGS ERECTED IN 1899

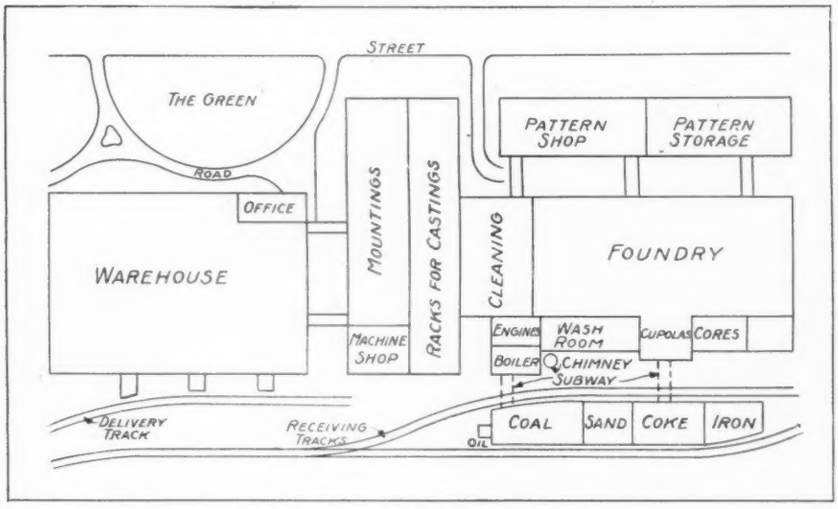


FIG. 6—PLAN OF EXPANSION PROPOSED IN 1899

bolted to the other piece, the resultant two-part casting replacing the single piece at a considerably lower production cost. The adoption of the molding machines for a large part of the emergency work in connection with the government order also was responsible for a great saving in flasks.

The wood patterns are made in the shop shown in Fig. 19. An adjacent room, equipped with similar woodworking machinery serves as a flask shop. Metal patterns and pattern plates are made in what is known as the "iron pattern shop" in the building containing other patternmaking and storage rooms. Fig. 20 is a view through the center aisle of the pattern storage building. Patterns and plates are arranged on numbered racks grouped in sections designated as *A*, *B*, etc. The pattern equipment for a certain stove is grouped on a shelf of one of the racks, and given the section letter and rack number, an attendant can readily find any pattern desired.

Preparing Sand for Stove Molding

Granting that the stove patterns used by the molders always are in first-class condition, smooth, fine-grained castings cannot be produced unless the molding sand is of the required quality. The Walker & Pratt Mfg. Co. uses a high grade of fine Albany molding sand and submits it to a drying and milling treatment that has proved highly satisfactory. The sand house is situated south of the main foundry buildings. The sand is unloaded from railroad cars on either side of the building into large bins, one of which is shown at the left in Fig. 9. The sand is placed on the four tables shown in Fig. 8, and is subjected to the heat radiating from steam coils. When it is thoroughly dried, the sand is scraped off into the specially-made

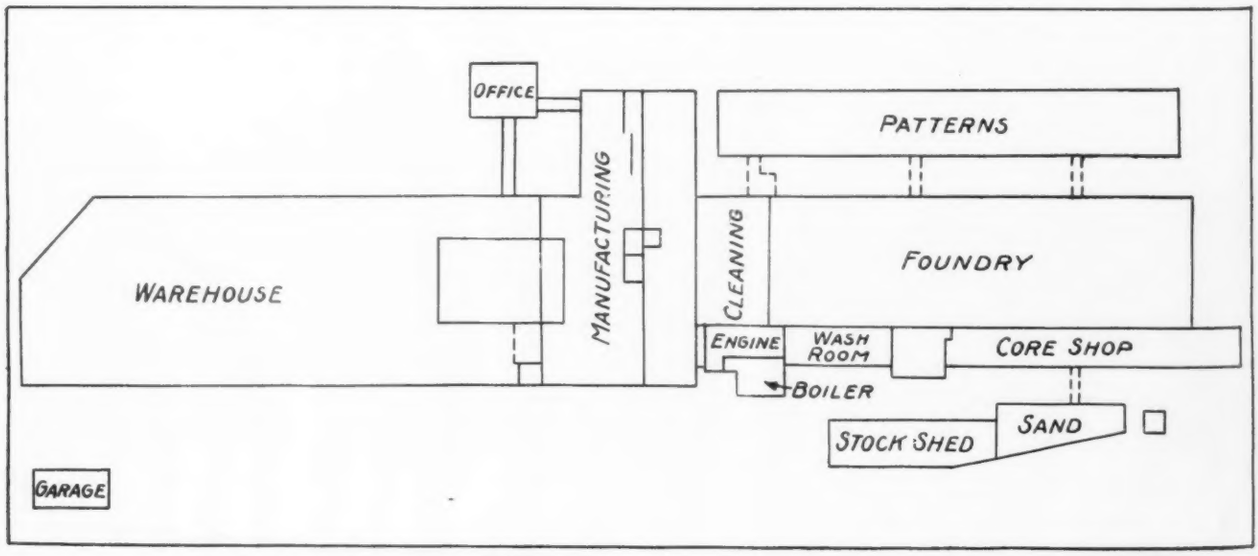


FIG. 7—PLAN OF THE STOVE PLANT AS IT EXISTS TODAY—A COMPARISON OF THIS DRAWING WITH FIG. 6 SHOWS HOW ACCURATELY THE GROWTH OF THE BUSINESS WAS PREDICTED IN 1899

wheelbarrow shown in the illustration. The sand then is dumped through a grating in the floor onto a bucket conveyor which carries it to a crusher overhead. After the sand has been thoroughly milled by the crushing rolls, it passes through a 30-mesh sieve, and into a bin terminating in two hoppers, shown in Fig. 10. Each hopper holds just enough sand to fill the five metal boxes on each side of the carrier shown in the illustration. The boxes are filled by first pulling out slides, *A A*, allowing the lower part of each hopper to fill up, closing *A A*, and pulling out slides *B B*. The carrier, supported by a 1-ton chain hoist, running on a 10-inch I-beam, is pushed through a subway to a point under the core room in the main foundry building, where the I-beam trolley track matches a section of similar track mounted on an elevator. The sand carrier is lifted to the level of the core room and foundry, where the I-beam track matches a section of the monorail system which serves the main foundry building. The sand carrier is then pushed to any desired molding floor, where the attendant distributes the boxes of sand, each box containing 100 pounds which is a convenient amount to handle.

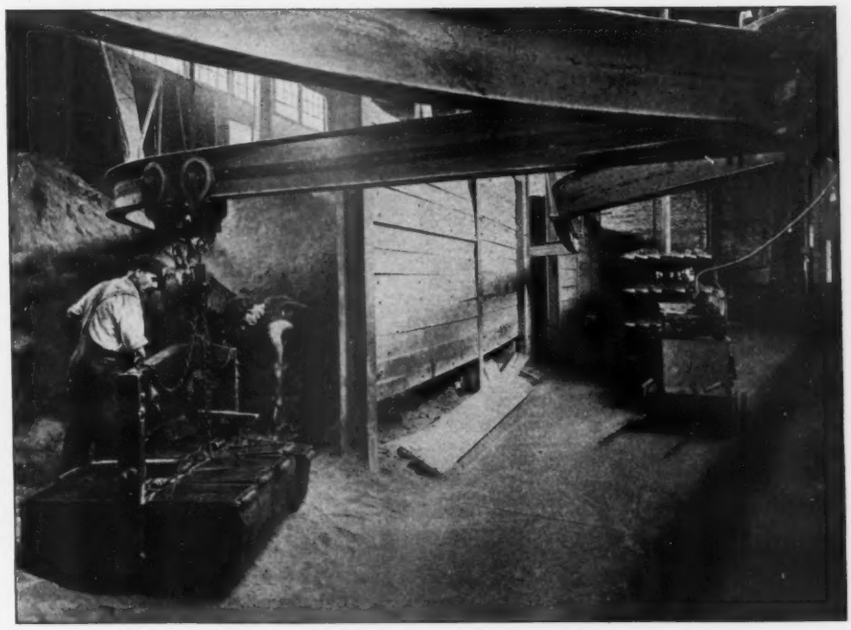


FIG. 9—STORAGE BIN IN SAND HOUSE AND CARRIER FOR CONVEYING SAND

Insuring Smooth Surfaces

In molding stove plate, it is extremely important that the surfaces exposed to view after the stove is assembled are made as smooth in the molding operation as possible. To make sure that only the purest metal collects at the outer surface of a casting, the side on which the smooth finish is desired faces the bottom of the mold. A good surface is further insured by facing the mold with a powder of fine charcoal and black lead, and printing-back, by placing the pattern for a moment on the facing and returning it. The molding floors of the foundry are in two adjoining bays, each of which is 60 feet wide and 420 feet long. An area of 100 x 120 feet at the east end of the building is devoted to machine molding. Light hand molding is done in the west section of the north bay, and heavy furnace work is molded in the west part of the south bay. As shown in Fig. 7, the engine, wash and core rooms adjoin the main foundry buildings on the south. Fig. 12 shows a section of the hand molding department and Fig. 11 illustrates one bay of the extension devoted to machine molding. It will be noted from these views that the molding floors are of concrete and that the runways under the monorail system are depressed about ½ inch below the level of the main floor. Typical machine-molded

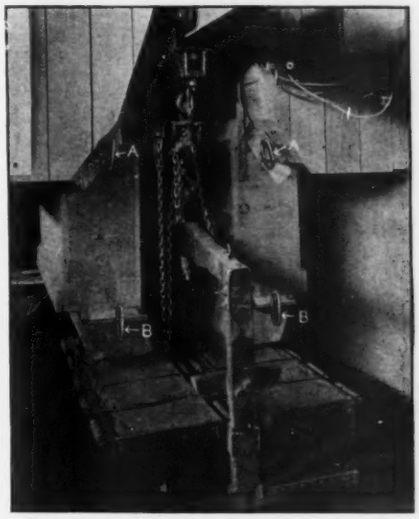


FIG. 10—HOPPER FOR FILLING SAND DISTRIBUTING BOXES

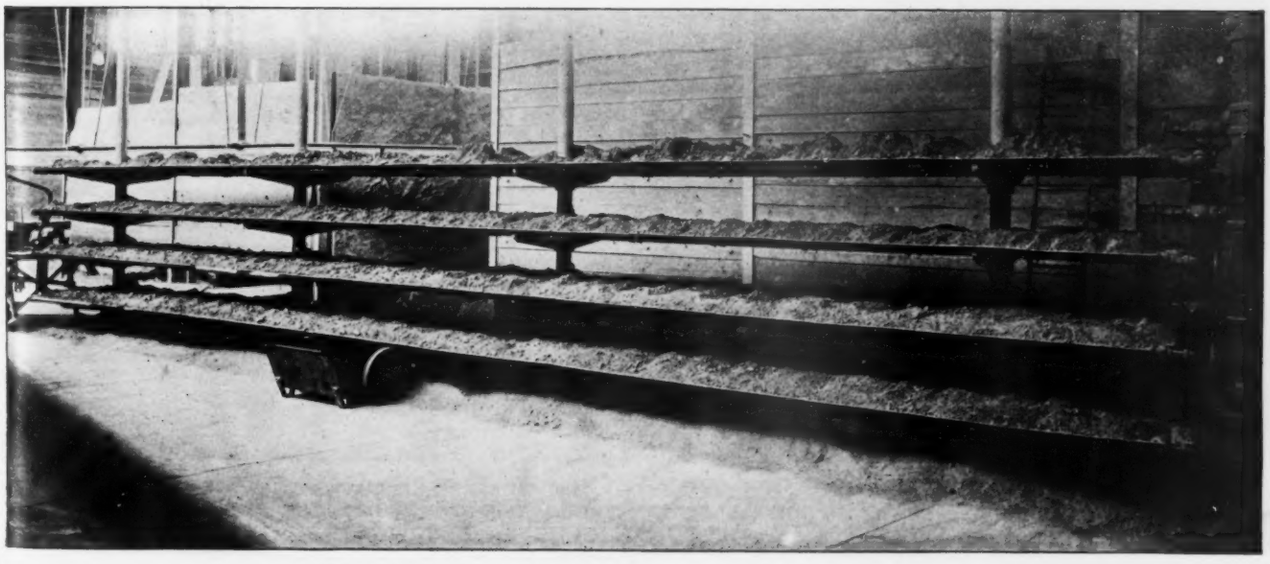


FIG. 8—ALBANY MOLDING SAND IS DRIED ON TABLES HEATED BY STEAM COILS

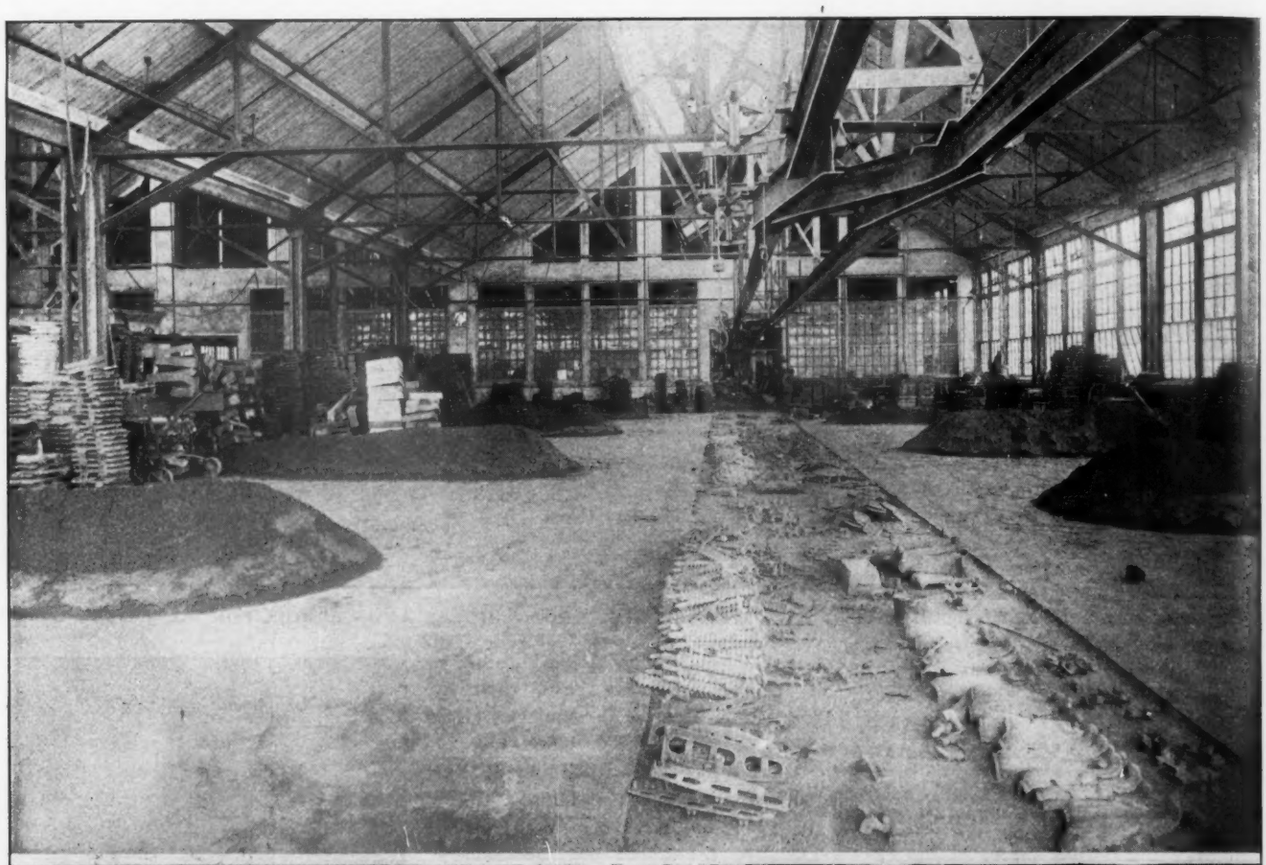


FIG. 11—MACHINE MOLDING ROOM—NOTE CONCRETE FLOOR WITH DEPRESSED RUNWAY. THE MONORAIL SYSTEM IS CLEARLY SHOWN. FIG. 12—SOUTH BAY OF THE FOUNDRY PROPER WHERE THE HEAVIER STOVE CASTINGS AND THE BOILER SECTIONS ARE MOLDED

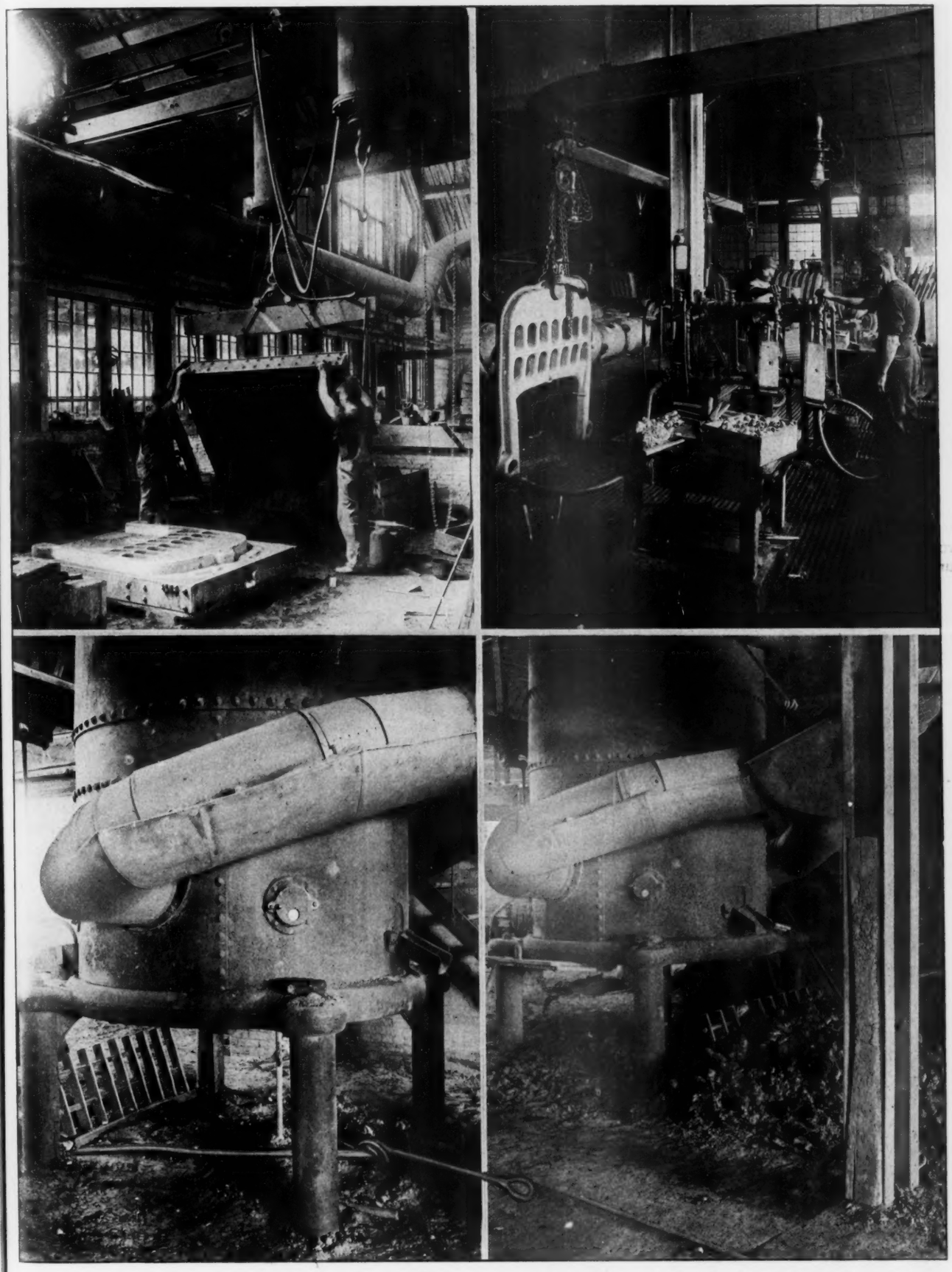


FIG. 13—CLOSING MOLD FOR LARGE BOILER SECTION. FIG. 14—ERECTING BOILER SECTION FOR HYDRAULIC TEST
FIGS. 15 AND 16—DRAG USED IN CONJUNCTION WITH CHARGING ELEVATOR TO REMOVE CINDER WHEN BOTTOM OF CUPOLA IS DROPPED

FIG. 17—METHOD OF CARRYING MOLTEN IRON FROM CUPOLAS TO THE MOLDING FLOORS, A DEPARTURE FROM THE USUAL PRACTICE

stove castings that have been shaken-out from the molds are shown in the runway in Fig. 11.

Molding Boiler Sections

The largest castings made in the Walker & Pratt foundry are sections for heating boilers. Fig. 13 shows the drag of a mold for a boiler section with the core in place. The cope is being lifted by the aid of a 14-inch air hoist. The cores for molds of this kind are made in halves in large metal core boxes, and are later pasted together. The 14 openings through the casting are formed by projections in the cope and drag instead of by the use of separate cores. The mold is gated at either end, to permit simultaneous pouring from two ladles. Fig. 14 shows a boiler section being set up for test. Each section is subjected to a hydraulic pressure of 100 pounds per square inch.

The melting equipment of the foundry consists of three cupolas, one of which is held in reserve. The charges of pig iron, coke, limestone and scrap stove plate are made up in small cars in a stock room adjoining the sand house. The cars run on a narrow gage track through a subway to an hydraulic elevator which lifts them to the charging floor, shown in Fig. 18.

Novel Use of Elevator

Figs. 15 and 16 show a unique method of dropping the cupola bottom after the iron has been tapped. The drag, in the position shown in Fig. 15, is attached to the hydraulic charging floor elevator by a wire cable passing through blocks placed at convenient points in the elevator well. When the elevator rises, the drag grips the bottom supports and sweeps the falling cinder to the back of the cupola, as indicated in Fig. 16.

The distribution of iron to the molding floors in the Walker & Pratt foundry is accomplished by bull ladles supported from trolleys running on a 10-inch I-beam track. It is customary in many stove foundries to tap the metal into the hand ladles from the cupola, and even in the most recently built stove plants, molders are required to go to the cupola for their iron. The monorail system enables the molders to remain at their respective molding floors, and lessens the confusion and danger of accident in handling molten iron. The arrangement of the ladles and cupola monorail system is illustrated in Fig. 17.

FIG. 18—THE CHARGING PLATFORM IS OF AMPLE PROPORTIONS—THE CHARGES ARE WEIGHED BEFORE THEY REACH THE CHARGING LEVEL

In cleaning the stove castings, ordinary imperfections are removed by grinding on double-stand machines, while irregularities on concave surfaces are ground on vertical grinders. The tumbling barrel equipment consists of about 30 cylindrical and rectangular units. Although each machine is equipped with exhaust pipes for carrying away the sand and dust, additional precaution against dust-laden air in the cleaning room is taken by placing heavy canvas covers over the tumblers. One of these covers, made of three strips of canvas tacked to wooden cleats, is shown in Fig. 22.

Cleaned Castings are Stored

The cleaned castings are weighed, inspected for defects, sorted, and then stored in racks in a casting storage room. The storing of cleaned castings, although requiring considerable floor area, has an important bearing upon the scheduling of work in the foundry. If it were not for the facilities for storing large numbers of stove parts, it would be necessary to carefully co-ordinate the work on various pieces, so that each of the many parts for a given stove would reach the assembling room at approximately the same time. The storage room, however, enables the molding department to plan its work to suit the available molding equipment, the wider latitude of management afforded in this respect tending toward greater economy in production.

The assembly of stoves involves not only the mere fastening together of the various pieces, but also the drilling and fitting of the parts which are held by bolts or screws. As previously stated, the policy of making many of the stove parts interchangeable reduces the work of fitting to a minimum. As a general rule, the body of the stove is assembled, while the legs, extensions, and other accessories are shipped knocked-down. A mounter first assembles a skeleton stove, starting with the base. In the case of the ranges for the army cantonment, the base is bolted together on a flat surface board, and the frame quickly assembled. While two mounters are engaged in this work, a fitter obtains the required doors, burners, lids, etc., from the casting room and fits them to the partially mounted stoves. Each fitter is able to provide fitted parts for the stoves which two mounters assemble. The slight alterations required to

FIG. 20—A VIEW THROUGH THE CENTER AISLE OF THE PATTERN STORAGE BUILDING

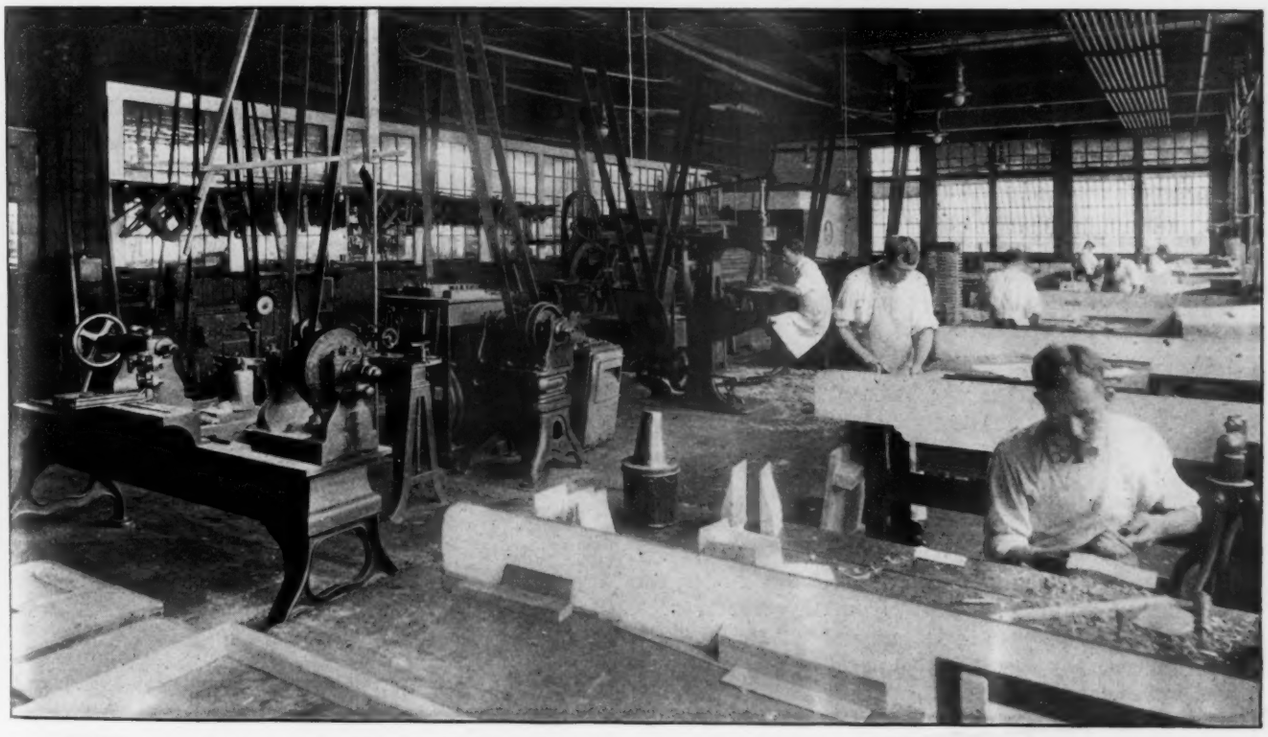


FIG. 19—A VIEW OF THE PATTERN SHOP WHERE THE WOOD PATTERNS ARE MADE—SEPARATE SHOPS ARE PROVIDED FOR METAL PATTERNS AND WOOD FLASKS

FIG. 21—THE BUFFING AND POLISHING DEPARTMENT WHERE NICKEL-PLATED PARTS ARE HANDLED

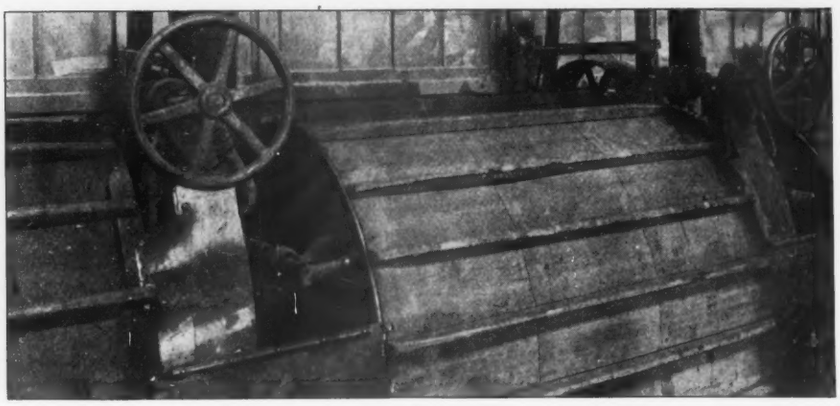


FIG. 22—A CANVAS COVERING OVER THE TUMBLING BARREL ALLEVIATES THE DUST NUISANCE

IRON PATTERN SHOP
(Underline your answer)

Are fire pails accessible and well filled?	Yes	No
Is the chemical extinguisher in good order, filled ready for use?	Yes	No
Are any of the waste cans overflowing?	Yes	No
Is cotton waste properly cared for?	Yes	No
Is the space under benches perfectly clean?	Yes	No
Are the fire doors of pattern vault free from all obstruction which would prevent opening and closing?	Yes	No
Is the general order and neatness the very best?	Yes	No
Is a wrench for sprinkler valve in place at door?	Yes	No
Do you see any dangerous gear, belt, or other moving part that should be more carefully guarded?	Yes	No
Can you make any suggestion that might prevent an accident in this department?	Yes	No

CLEANING ROOM
(Underline your answer)

Are fire pails accessible and well filled?	Yes	No
Is the general order and neatness good?	Yes	No
Is a wrench for sprinkler valve in place at door?	Yes	No
Do you see any dangerous gear, belt, or other moving part that should be more carefully guarded?	Yes	No
Do you see any unsteady or dangerous piles?	Yes	No
Can you make any suggestion that might prevent an accident in this department?	Yes	No

FIG. 23—FACSIMILE OF PAGE OF FIRE EQUIPMENT INSPECTION BOOK

make certain castings fit in place are made on grinding wheels. There are approximately 400 pieces is an ordinary cooking range.

The assembled stoves are inspected, blacked and polished, after which the nickeled and enameled parts are mounted. In some cases the blacking is applied by a spray system in an enclosed room specially-built for this purpose. Fig. 24 is a view of the nickel-plating vats in the plating department and Fig. 21 shows the battery of grinding and buffing wheels where plated parts are prepared for the bath and polished after plating. No. 150 carborundum is used in this department, experience having proved that this material is of the proper degree of fineness to produce a desirable finish, and yet thorough enough as an abrasive to dress up the surface without scratching.

Handling Stoves in Warehouses

The stoves are carried to the warehouses on an electric storage battery truck, as shown in Fig. 25. As the floors of the storage department have almost an unlimited capacity, stoves may be piled to the ceiling. The handling of the stoves is facilitated by simply constructed traveling cranes equipped with 1-ton chain hoists, one of which is shown in Fig. 26. A stock of from 4000 to 7000 ranges, depending upon the time of the year, is maintained in the warehouses.

Carload shipments are loaded in cars switched to the plant on a siding from the Boston & Maine railroad at Union Market station. Stoves destined for New England points in less than carload lots are carried in 5-ton automobile trucks to Boston freight terminals, from which nightly freight service provides transportation facilities almost comparable with express service.

In tracing the various steps of stove manufacture, it was impossible to men-

tion a number of details of plant construction and equipment that greatly influence the efficiency of stove production. In the July, 1899, issue of THE FOUNDRY, the reference to the washroom facilities of the then new Walker & Pratt plant, indicates that even 20 years ago, the company was alive to the necessity of providing sanitary conveniences for its employes. The New England molder has formed the commendable habit of effecting a complete change of attire when starting and quitting work in the foundry. To encourage the continuance of this practice, a number of unusually well-equipped washrooms have been provided for the workmen. Each man is assigned an individual locker and pegs on a clothes drying rack. An ingenious bracket affixed to the bottom of each locker door secures a galvanized iron pail which is only released when the locker door is open. These pails are used by the workmen in washing. Wash basins and shower-bath compartments are provided in each washroom.

Precautions Against Fire

The predominance of wood in foundry construction in New England has necessitated the employment of unusual precautions against fire. Although the Walker & Pratt plant is amply protected by an extensive automatic sprinkler system, hydrants, hose, etc., an additional safeguard in the form of a monthly inspection of fire-fighting equipment and the condition of the property is provided. A committee makes a tour of inspection on the fifteenth of each month, noting its findings in an inspection book, one page of which is reproduced in Fig. 23. The book eliminates errors of omission, as an answer is required showing the condition of every important detail in the plant.

Perhaps the most striking feature

FIG. 25—STOVES ARE EASILY CARRIED ABOUT THE PLANT ON A STORAGE BATTERY TRUCK

FIG. 26—A SIMPLY CONSTRUCTED TRAVELING CRANE FACILITATES PILING STOVES IN WAREHOUSE

FIG. 24—A VIEW OF THE VATS IN THE NICKEL-PLATING ROOM

of the plant is the superintendent's of foundry executives have been given office. As a general rule, the offices little attention in the past, and even in many of the modern casting plants, the offices consist of rooms formed by temporary partitions in the main foundry buildings. At the Watertown stove plant, the offices occupy a separate building situated in the small park at the north of the plant. The two walks connecting the offices with entrances to the plant are roofed over and walled on one side, affording protection against the weather. The office building, as it appears from the entrance to the grounds, is shown in Fig. 3. The vestibule of the building leads to a large room which will ultimately be used for the display of stoves. The floor of this room is of tile and the walls have an oak-finished wood wainscoating. The ceiling is paneled off into squares by heavy woodwork, and electric lamps suspended in the center of each square afford indirect light. The offices proper, as shown in Fig. 2, occupy an alcove in the west side of the building. The superintendent's private office is in the corner of the building at the left in Fig. 2. Fig. 1 indicates how foresight in planning many years ago has enabled the company to develop beautiful grounds around the plant.

To Build Electric Furnaces

T. H. Watson & Co., Sheffield, Eng., have formed an American corporation to handle their electric furnace business in the United States and Canada. The Watson company controls the Greaves-Etchells electric furnace. The new American company will be known as the Electric Furnace Construction Co. and its offices will be in the Finance building, Philadelphia. Over 30 Greaves-Etchells furnaces are in operation in the Sheffield district in England, ranging in capacity from 1000 pounds to 12½ tons. The American company has already taken orders for 6-ton equipments to be installed at the United States navy yards at Bremerton, Norfolk and Honolulu. The new company will be headed by Frank Hodson, one of the partners of T. H. Watson & Co. F. J. Ryan, formerly eastern manager of the Snyder Electric Furnace Co., will be general manager of the Electric Furnace Construction Co.

The Whiting Foundry Equipment Co., Harvey, Ill., now is directly represented in Pittsburgh and vicinity by F. J. Page, located at 411 Fulton building. Mr. Page has been in the employ of the Whiting Foundry Equipment Co. for many years in both the estimating and sales departments.

New Plant of Keller Pneumatic Tool Co.

The new plant of the Keller Pneumatic Tool Co., Grand Haven, Mich., has been completed and arrangements have been made to begin the removal of the equipment from the plant at Fond du Lac, Wis., during the month of September. The new plant has been laid out in units and it is planned to remove one unit from the old plant at a time and in that way present production will be maintained. The Keller Pneumatic Tool Co. has enjoyed a rapid growth under the management of W. H. Keller, president and general manager; Wm. H. Loutit, vice president, and Arnold J. Petri, secretary and treasurer.

Performance of Melting Furnaces

In a communication to THE FOUNDRY, Harry E. Kies, manager of the malleable department of the American Radiator Co., Buffalo, states that he is now melting 72,000 pounds daily in the melting furnaces which were descrbied in detail in the article entitled "Removing Traditional Evils of Malleable Practice", published in the February issue of THE FOUNDRY. The iron is being tapped 12 to 13 hours from the time the blast is put on. The heats are run off without skimming, the slag being taken off after the iron has been tapped from the furnaces. The metal is remarkably uniform in temperature and strength and varies from 54,000 to 58,000 pounds per square inch, in tensile strength. The castings made from this metal range from the lightest malleable sections to the heaviest parts used in automobiles.

Mixture of Iron for Permanent Molds

Since the publication of the article in the July issue of THE FOUNDRY, page 274, entitled "The Early Use of Permanent Molds for Castings", by Alex. E. Outerbridge Jr., numerous inquiries have been received regarding the mixture best suited for this work.

Mr. Outerbridge states that "the analysis of the iron depends largely upon the size of the castings to be made and upon the dimensions of the molds. For small castings any ordinary foundry iron is suitable, but permanent molds made of low silicon iron, such as car wheel iron, containing from 0.60 to 0.75 per cent silicon, permanently expand or grow much less when repeatedly heated and cooled above a low red heat on the interior surface, than molds made from ordinary foundry iron containing from 1.50 to 2.50 per cent silicon. The other elements in cast iron may vary so largely without materially affecting the permanent mold, that it is not necessary to give a detailed analysis".

The Abell-Howe Co.

The Abell-Howe Co., 565 Washington boulevard, Chicago, has been incorporated to provide for the expansion of the sales and engineering organization inaugurated some months ago by Oliver J. Abell. The new company has acquired important interests in some of the manufacturing companies for whose products it will be the national distributor, and in addition, it will continue to market other equipment as sales agent. Among the products to be sold exclusively through the Abell-Howe Co., are American high speed chain and Howe detachable tongue trucks.

Oliver J. Abell is president and treasurer of the new company, Glenn G. Howe is vice president and C. E. Kane secretary. Arrangements for representation in the principal distributing centers of the country will be shortly completed.

Again Stevens Dips His Pen

This, That and Then is the title of an 80-page house organ issued by Frederick B. Stevens, Detroit, which is unique in its text since it contains a clever intermingling of light literature with trade reading applying to the business of supplying the wants of the foundry, polishing and plating industries. This pamphlet is the successor to *That and This,* published less than a year ago and which attracted considerable attention at that time. Every page of this work bears the Stevens' individuality and discusses among other subjects, "The Gugglesnack Mystery", "Billy" Sunday, "Dandy Dollar Diggers", etc.

The annual Providence outing of the New England Foundrymen's Association was held Aug. 8 at the Pomham Club, overlooking Narragansett bay. It was attended by upwards of 120 members and a typical Rhode Island clambake was served. The committee on arrangements consisted of W. A. Viall, Henry A. Carpenter and Alfred J. Miller.

H. Kramer & Co., Chicago, metal refiners, smelters and dealers, now are located in their new foundry and warehouse, built on a 1-acre site at 1324 to 1344 West Twenty-first place. Shipping facilities are provided by a side track connecting directly with Chicago, Burlington & Quincy railroad. This company purchases type dross and brass skimmings and ashes.

Melting All-Scrap in Electric Furnace

Low Phosphorus Pig Iron, Washed Metal and Steel for Casting Purposes Are Melted Interchangeably—Low Conversion Costs

By R V Sawhill

ALL-SCRAP mixtures are being used in two electric furnaces now operating in a foundry at Watervliet, N. Y., where iron and steel for the company's own castings are melted interchangeably with low phosphorus pig iron and washed metal which is sold in the open market. Remarkably low conversion costs are revealed in figures prepared at the plant.

In general foundry work it is pointed out that these furnaces enable the melter to turn out a metal of any desired carbon content starting from ordinary steel scrap. Although the cost of melting cast iron in the electric furnace undoubtedly is higher than in the cupola, it is claimed this is more than offset by the difference in the price of the raw material which the electric furnace makes it possible to use.

This furnace represents a number of years of experimental effort. The conversion loss when melting metal for steel castings is said to be less than 5 per cent.

An additional factor in the cost is that the cheapest iron and steel scrap available are used for remelting. Gray iron has been satisfactorily produced to meet the specifications required from steel scrap alone. The analysis of the metal in the ladle is controlled by adding the deoxidizers and ferro-alloys necessary to bring the melt within specified limits, accurate knowledge being maintained at all times of the composition of the metal so that the exact additions required can be made. An outline of the work which these furnaces have been called upon to perform is shown by the accompanying table of the average analyses of the pig iron, washed metal and castings which have been produced during recent weeks. The figures show the average analyses, but it has been found practicable to produce metal of widely different chemical composition, including grades that contain exceedingly low phosphorus and sulphur. The combined phosphorus and sul-

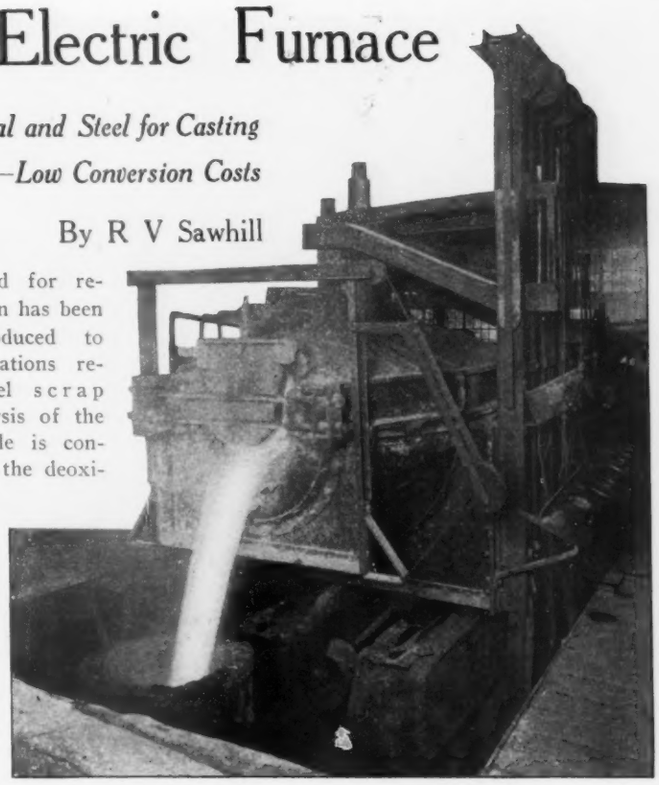


Fig. 1—Pouring Iron Turned Out From All-Scrap Mixture

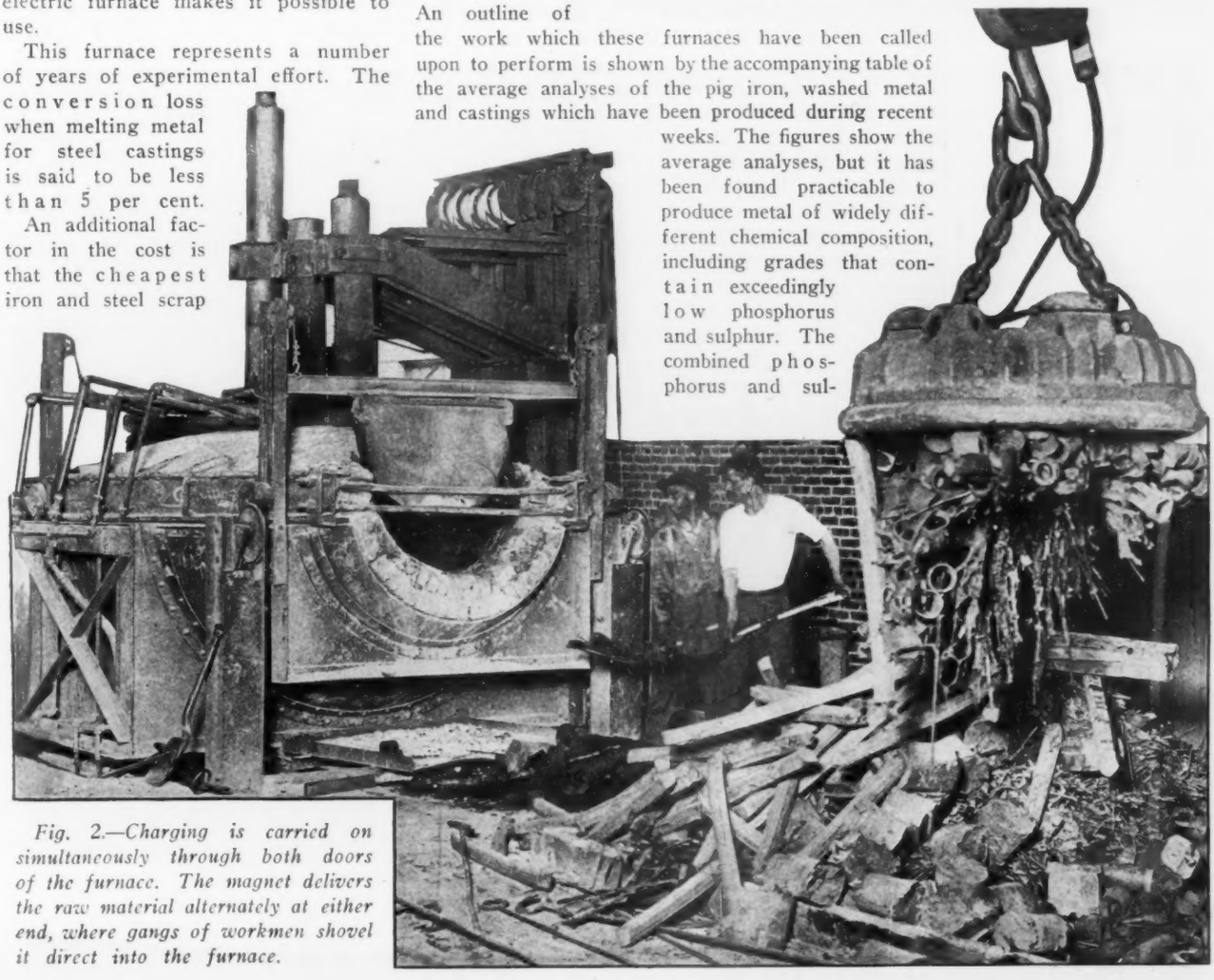


Fig. 2.—Charging is carried on simultaneously through both doors of the furnace. The magnet delivers the raw material alternately at either end, where gangs of workmen shovel it direct into the furnace.

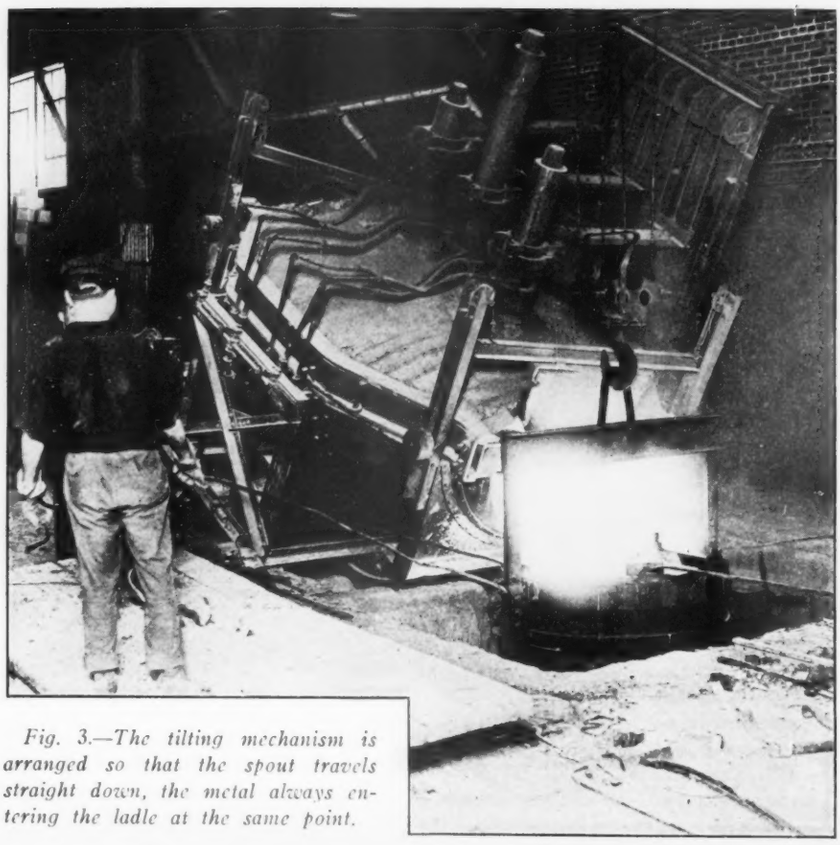


Fig. 3.—The tilting mechanism is arranged so that the spout travels straight down, the metal always entering the ladle at the same point.

phur content has been reduced to 0.015 per cent. The average analyses of pig iron, washed and casting metal made in this furnace, follow:

AVERAGE ANALYSES.

	Pig iron, per cent	Washed metal, per cent	Casting metal, per cent
Carbon	3.730	3.550	3.360
Sulphur	0.008	0.020	0.019
Phosphorus	0.030	0.014	0.024
Manganese	0.350	0.370	0.360
Silicon	1.500	0.200	1.300

The furnaces used were originally developed by the Ludlum Steel Co., Watervliet, N. Y., for producing tool steel. This company began a series of experiments some six or seven years ago under the supervision of Max Trembour, chemist in charge of melting. The Ludlum company in 1912 began to use its new type of electric furnace exclusively in all melting operations, a decision which was all the more striking in view of the company's use of crucibles for producing its high-grade steels ever since the concern was organized in 1854. The new electric furnace is described by one of the Ludlum officials as an electrically-heated crucible in which all chance for oxidation is avoided.

Mr. Trembour, when he began his experiments, started to build a fur-

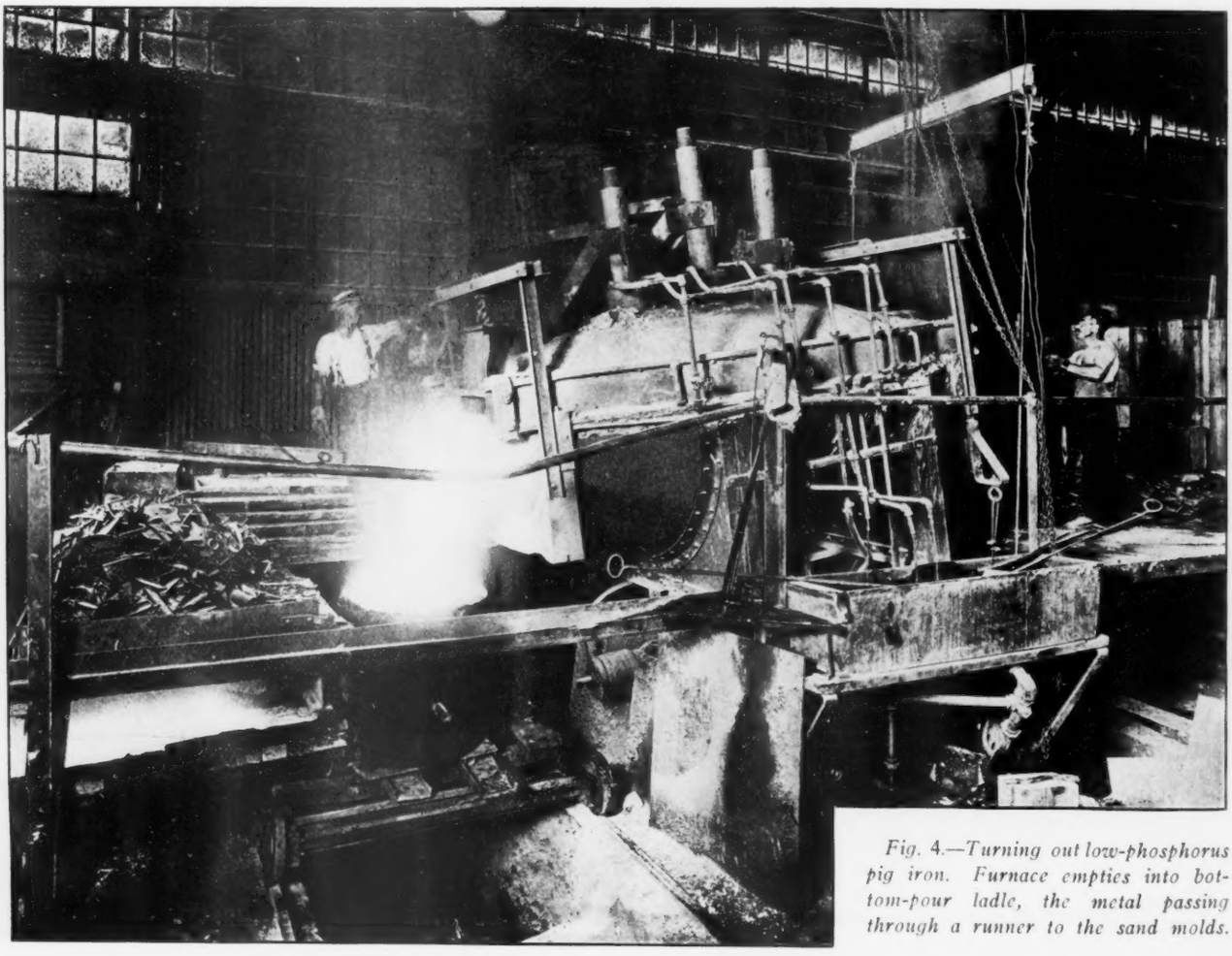


Fig. 4.—Turning out low-phosphorus pig iron. Furnace empties into bottom-pour ladle, the metal passing through a runner to the sand molds.

nace around the electrodes, rather than to adapt the arrangement of the electrodes to the shape of the furnace. His preliminary work was carried out on the assumption that the shape of the furnace was of primary importance in determining the efficiency of operation. As a result of his studies, he evolved an elliptical-shaped furnace with three electrodes arranged in a straight line. This arrangement, according to the men associated with the operation of the furnace at the Ludlum plant, effectually prevents cold spots and gives a high degree of uniformity to the heat distribution. In substantiation, these operators point to observations which have shown that when the cold fringe around the bath becomes molten all the center of the bath proves to have been thoroughly melted at the same time.

The furnace in its present form was developed only as a result of thorough experimentation with a number of original types. These included small single-phase, hexagon 3-phase and circular rotating types. After the present shape of the furnace and arrangement of the electrodes was decided upon, work was concentrated upon several small-sized units and finally upon a 1500-pound fur-

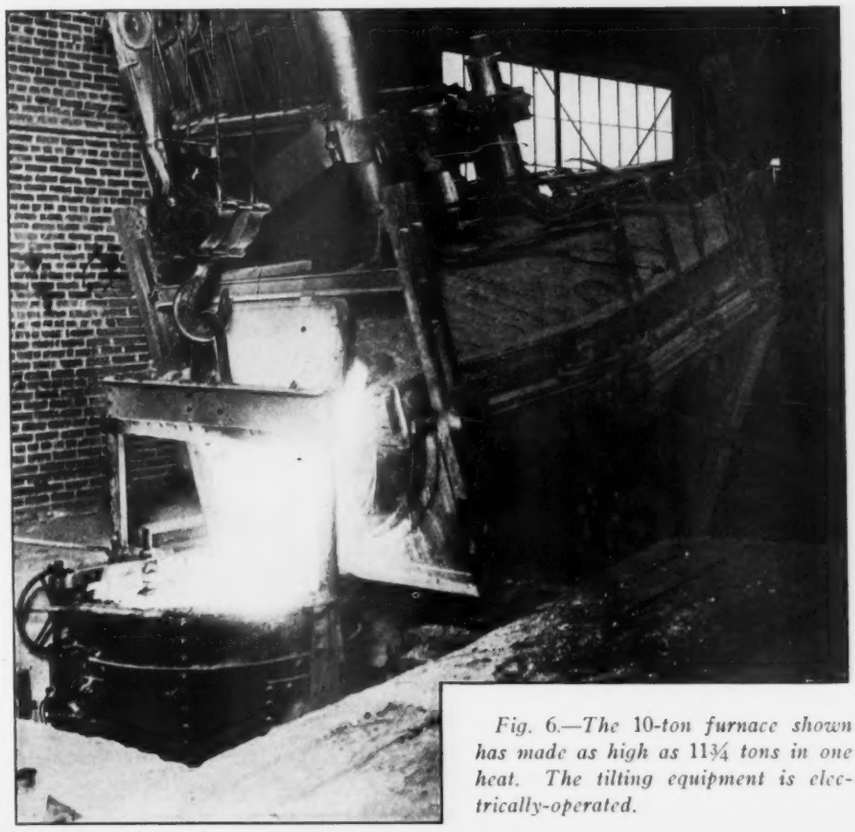


Fig. 6.—The 10-ton furnace shown has made as high as 11¾ tons in one heat. The tilting equipment is electrically-operated.

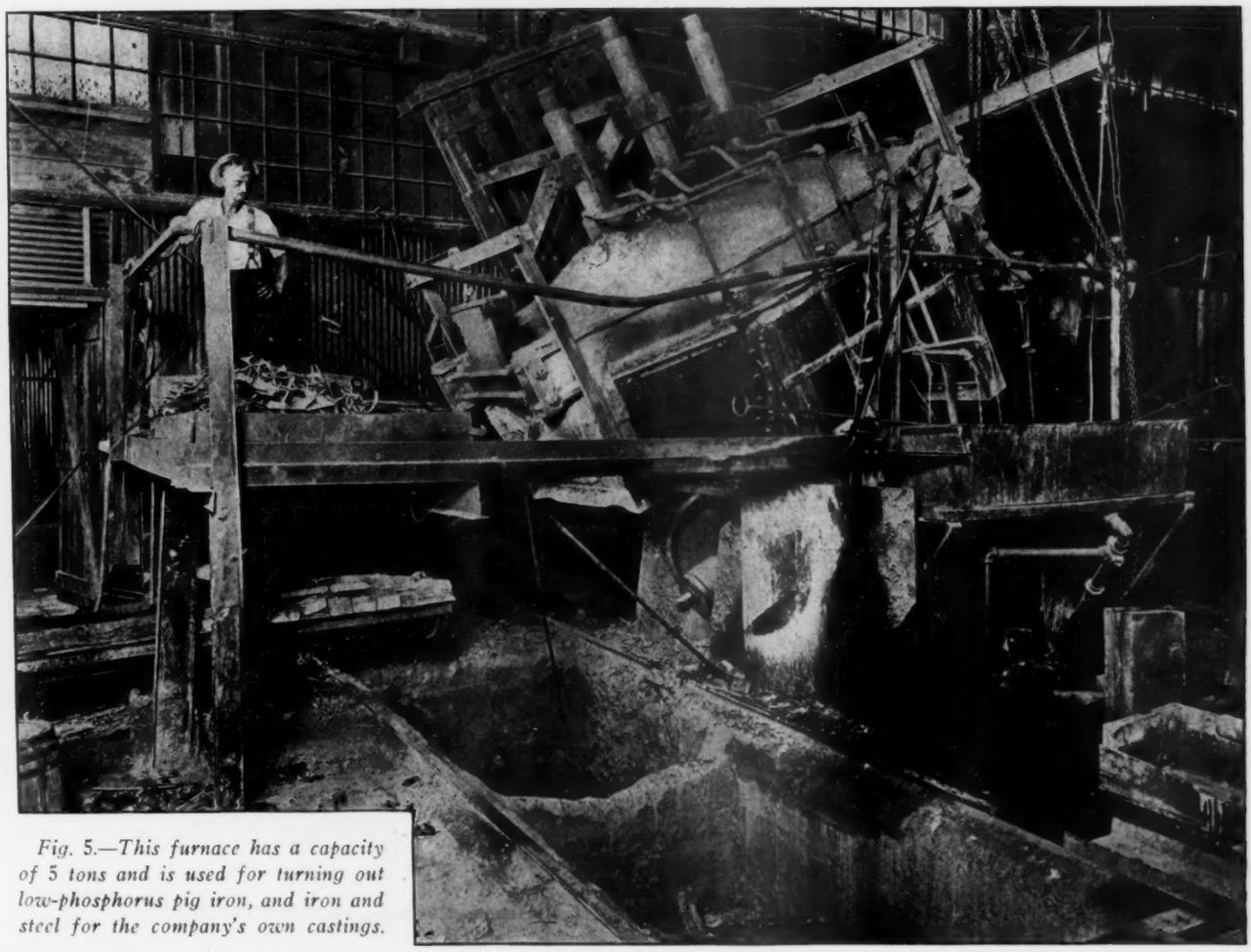


Fig. 5.—This furnace has a capacity of 5 tons and is used for turning out low-phosphorus pig iron, and iron and steel for the company's own castings.

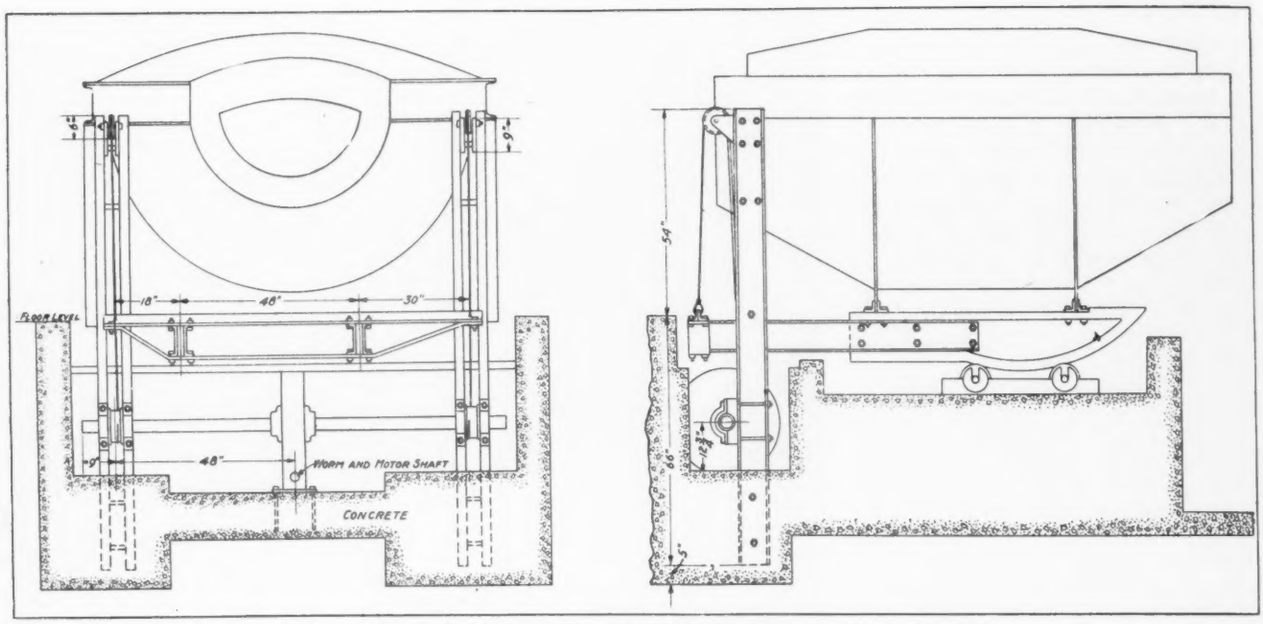


FIG. 7—DETAILS OF TILTING EQUIPMENT FOR 10-TON FURNACES

nace. The operation of this unit proving satisfactory, two 5-ton furnaces of the same design were built and these units are employed in the foundry work and in producing low phosphorus pig iron and washed metal. These furnaces are now operated under lease by the Sweetser-Bainbridge Metal Alloy Corp., Watervliet.

The Ludlum Steel Co. has used the electric furnaces solely for producing high-grade steels, as the melting units were developed not as a marketable product, but to meet the company's needs for producing larger tonnages of equal, or if possible, improved quality. Before leasing the 5-ton units, the company built two 10-ton furnaces, which it has been using in manufacturing its regular line of high-speed steel, permanent magnet steel, both chrome and tungsten, carbon tool steel, finishing steel and ball and bearing steel. The success of the venture can be measured by the rapid growth of the company during the past few years during which time it has become, in some of its lines, the largest producer in the country.

Several weeks ago a number of men familiar with the work of the electric furnaces at the Ludlum plant and the Sweetser-Bainbridge plant, formed a company to build and license these furnaces. This company has been incorporated under the name of the Ludlum Electric Furnace Corp.

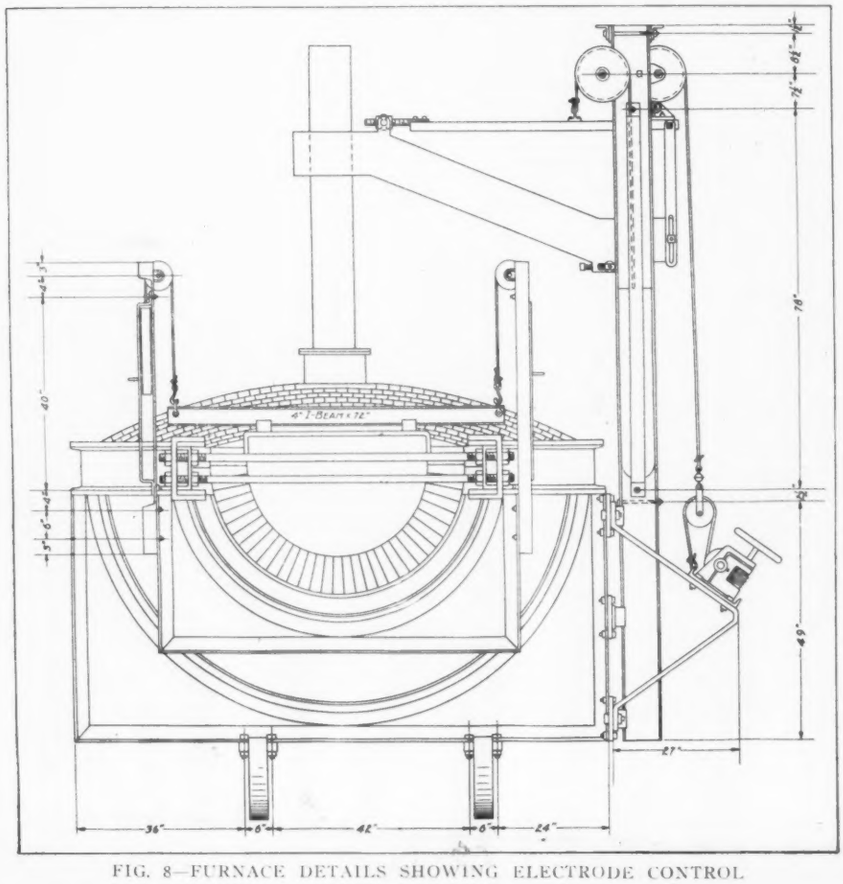


FIG. 8—FURNACE DETAILS SHOWING ELECTRODE CONTROL

Details of the Furnace

The furnace is of the arc type, with three electrodes arranged in a straight line. Modifications in the shape are believed by the designers of the furnace to explain largely the successful results which these units have given in operation.

A clear idea of the general arrangement and details of the furnace can be gained from Figs. 7, 8 and 12. The furnace has no perpendicular walls and owing to its shape, any portion is readily accessible for repairing, or when operating, for removing the slag. The use of two doors facilitates access to any part of the furnace; both doors are used when charging, while one is employed for pouring.

Fig. 12, showing the arrangement of the busbars, transformer and cable connections, reveals clearly the method of introducing the current into the furnace. Electricity is purchased from the Adirondack Power Co. and enters the plant at 11,000 volts. It is reduced in a 1500-kilovolt ampere transformer set furnished by the General Electric Co., Schenectady, N. Y.,

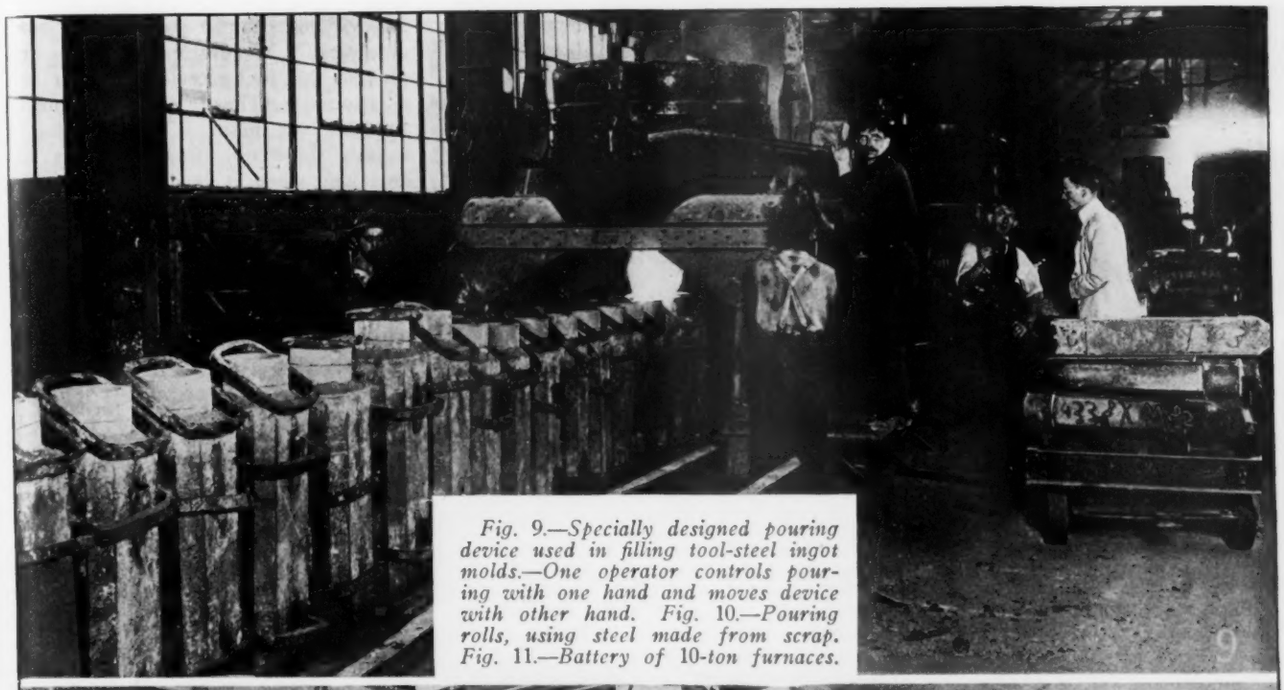
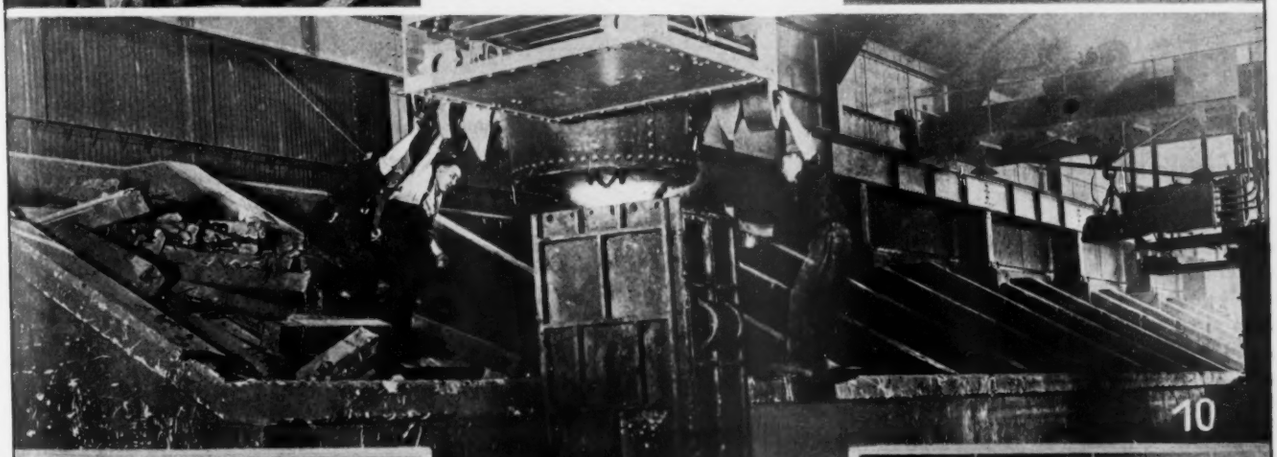
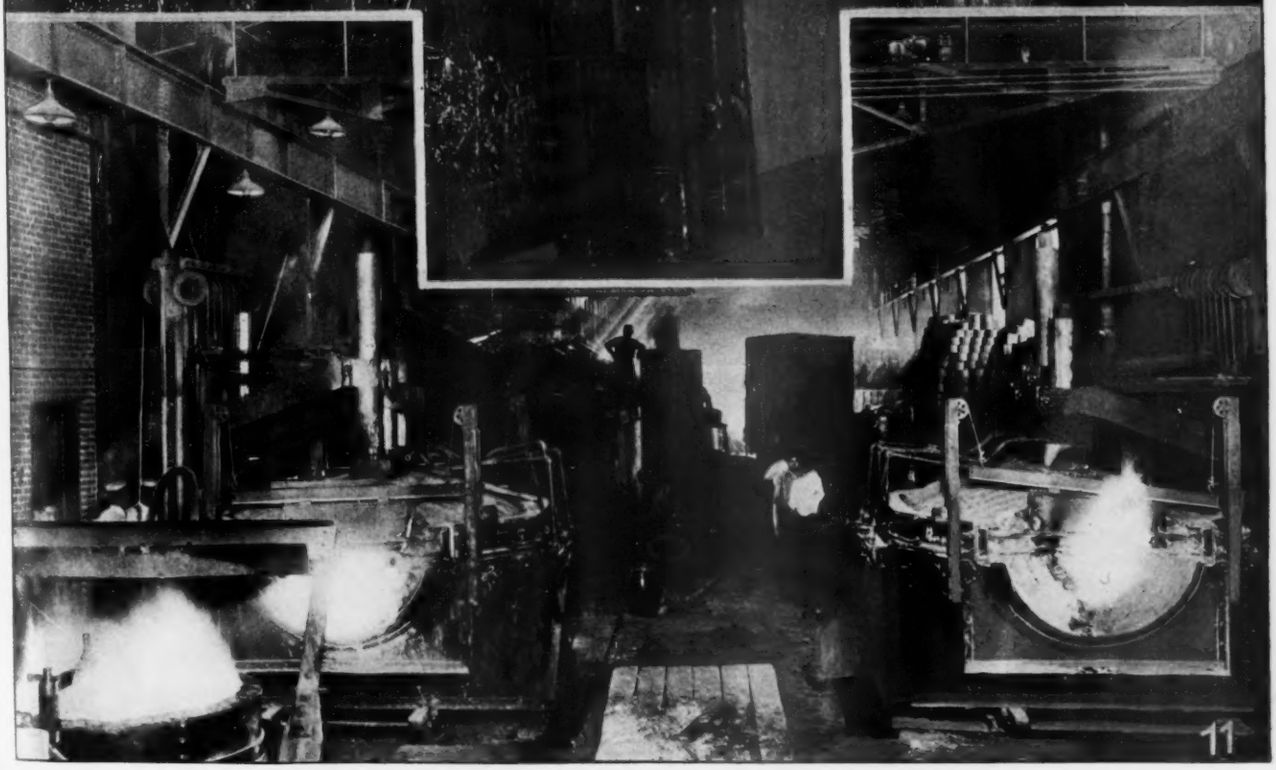


Fig. 9.—Specially designed pouring device used in filling tool-steel ingot molds.—One operator controls pouring with one hand and moves device with other hand. Fig. 10.—Pouring rolls, using steel made from scrap. Fig. 11.—Battery of 10-ton furnaces.





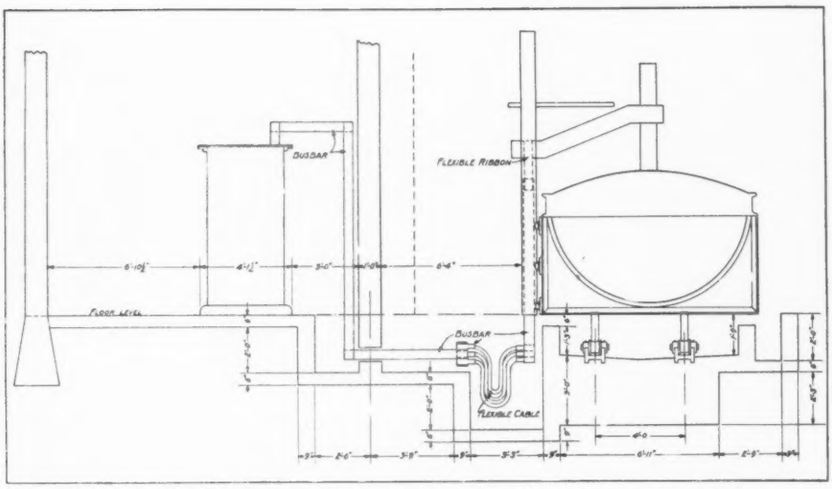


FIG. 12—ARRANGEMENT OF BUSBARS, TRANSFORMER AND CABLE CONNECTIONS

to 90, 95 and 100 volts. It is then brought to the furnace through the busbar and flexible cable connections shown. The flexible cable is provided to compensate for the tilting of the furnace.

Controlling the Electrodes

The position of the electrodes is controlled by hand wheels functioning through worm wheels and pulley, lead counterweights increasing the ease with which the hand wheels are moved. Roller bearings and set screws are employed to give greater flexibility in operating the electrode arms. The electrode holder is fastened to a rail which is raised and lowered by a cable passing over a wheel and through a pulley to the hand wheels. Plans have been prepared for installing automatic control, if desired.

The shell is 9/16-inch steel plate. The lining is comparatively thin. This, as the designer points out, is permitted owing to the uniform distribution of heat which is secured, with the consequent even wear upon all parts of the lining.

The problem of relining has been found to be relatively simple. With the 5-ton furnaces, a record of relining in 23 hours has been set. This time is computed from the minute

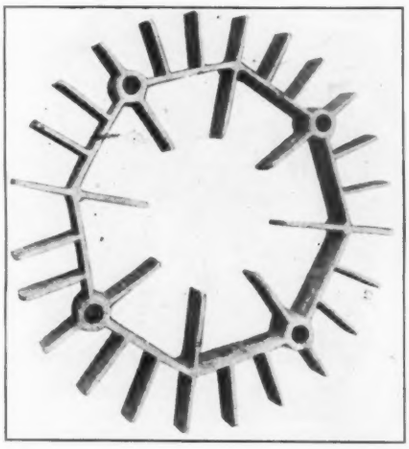


FIG. 14 — THIN-SECTIONED CASTING MADE FROM ALL-SCRAP MIXTURE

when pouring was completed until recharging was started. One of the furnaces which was pouring when the writer visited the plant had been run for 92 heats and was still in good condition. Magnesite lining is employed, this being reclaimed after use, as ground magnesite is in demand at the Ludlum plant. The relining is usually done on Sunday, and is undertaken when it is decided that the furnace will not run through the following week.

The construction of the roof is shown clearly in Fig. 13. The angle iron and independent rods are employed to take the thrust of the roof.

How Furnaces are Charged

The scrap for the 5-ton furnaces is stored close to the furnaces, all charging being carried out by hand. In the steel plant, a magnet is used to bring the raw material from the concrete bins in which it is stored according to grade. The magnet commands both ends of the furnace so that hand charging can proceed simultaneously through both doors. The complete details of charging the furnaces in the steel plant are shown in Fig. 2. The furnaces are filled to the top, packing being simplified by the ease with which all parts of the furnace can be reached.

In pouring, the 10-ton furnaces are tilted on rollers actuated by individual motors located below the floor at one end of the furnace. The arrangement of the rollers, motor and tilting equipment is shown in Fig. 7. Through the arrangement of these rollers, the spout has only a downward movement, and does not tilt either forward or backward. It was designed to keep the position of the spout in a fixed vertical plane, thus giving an even stream of metal which would enter the ladle at the same point. The 5-ton furnaces are tilted by hand, through a chain and pulley, as shown in Fig. 5.

In the Ludlum steel plant, the receiving ladle is lifted by a crane from the pit in front of the furnace and placed in a pouring device developed

FIG. 13—SPARE FURNACE ROOF, SHOWING CONSTRUCTIONAL DETAILS

by Thornton W. Price, an engineer associated with the Ludlum Electric Furnace Corp. Through a specially designed casting, the ladle, when placed on this device, is automatically brought into position directly over the ingot molds. The device runs on its own tracks, one operator controlling its forward movement with one hand wheel and opening and shutting the pouring spout with the other hand by means of a lever. The ingot molds ready to receive the metal as well as the pouring device in operation, are shown in Fig. 9.

In the foundry operated by the Sweetser-Bainbridge company the metal from the 5-ton furnaces enters a bottom-pour ladle, passing through a runner into the ordinary sand molds when casting pigs. When making castings, the metal is received in a 1500-pound ladle, which is controlled by a crane during pouring. The pouring arrangements in the foundry are shown in Fig. 4.

One man is employed to operate each furnace, with one melter watching several furnaces. The operators in both the steel plant and in the foundry are laborers who were trained to their work quickly and who serve under a trained supervisor. Some high production records have been made with this type of furnace, one of the 10-ton type having produced 11¾ tons in one heat.

Some of the work which is being done in the foundry is shown in Figs. 10, 14 and 15. Fig. 10 illustrates the method of pouring a large steel roll

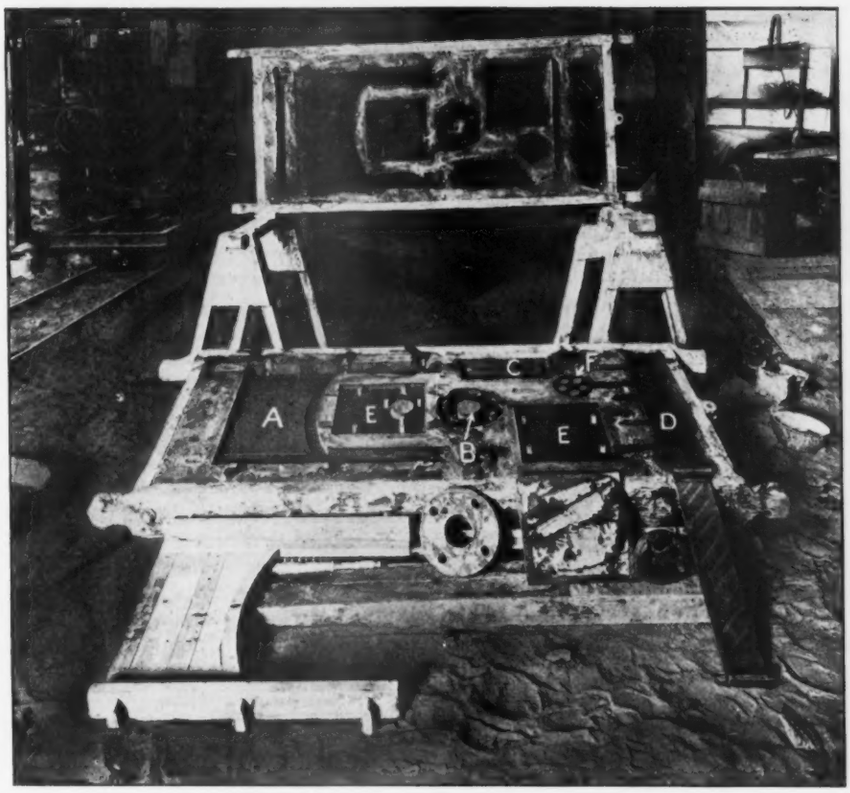


FIG. 15—DRAG AND COPE FOR GRAY IRON CASTINGS, USING MELTED SCRAP

used in the Ludlum mills, two rolls being poured at one time. Fig. 14 shows a steel casting having a number of thin sections, while in Fig. 15 are the drag and cope of a mold in which seven castings are to be poured at one time. In this illustration, *A* is a furnace door frame; *B* is a bushing or a bottom-pour ladle; *C* is a rest plate for a 9-inch mill; *D* is a flask bar; *E* is a right and left oil burner plate, and *F* is a wheel for the wire straightener.

Actual foundry operations in this plant have been conducted for only a com-

(*Continued on page* 409)

FIG. 16—INTERIOR OF FOUNDRY, SHOWING TWO FURNACES IN BACKGROUND

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Twenty-Five Years of Service

A QUARTER of a century has elapsed since THE FOUNDRY made its bow to the trade which it has served so well, and another curtsy is in order with the inaugural of this 25-year period that undoubtedly will surpass in progress anything heretofore recorded. In a generation the industry has passed from a rule-of-thumb basis to one of scientific precision, yet many mysteries remain unsolved and much bad practice is still to be improved. The development of the art of making castings has more than kept pace with that of iron and steel manufacture, although it is without the spectacular features of the latter. While accurate figures are not available, it is estimated that the output of iron and steel castings today is two-thirds of the entire pig iron manufactured annually 25 years ago. To speculate on the future, basing calculations on the past, almost staggers the imagination. With pig iron production at the rate of nearly 40,000,000 tons, and if the increment of the last 25 years is maintained, the iron and steel foundries should be making 25,000,000 tons of castings in 1942. Stupendous and probably as unattainable as this total may seem, nevertheless this forecast is no more startling than one that might have been made in 1892 to the effect that iron and steel castings would be produced at the rate of over 6,000,000 tons in 1917. In the future, as in the past THE FOUNDRY will continue to serve the interests of every branch of the casting industry. Without the continued loyal support of hundreds of advertisers and thousands of readers throughout the world, the success of this publication would not have been possible and this celebration affords THE FOUNDRY an opportunity to express to them its warm appreciation and hearty thanks.

Everybody's Going to Boston

EVERY progressive foundryman is going to be in Boston during the week of Sept. 24. The annual meetings of the American Foundrymen's Association and the American Institute of Metals, combined with the great exhibition of foundry supplies and equipment, machine tools and accessories constitute an event that is one of the greatest and most important features of our national industrial life. The war has accelerated, rather than retarded, the interest in this great gathering of foundrymen and machine shop operators. This is proven by the increase in the number of exhibitors and the floor space reservations over the totals at Cleveland last year. Every foundryman is directly affected by the speeding-up process that is essential to victory in this crisis. He must produce more than he ever made before, and with the employment of a reduced force. This means the installation of labor-saving machinery and at Boston there will be an array of tools that will meet every requirement. The technical sessions of the conventions of the two great societies of foundrymen are replete with papers on the manufacture of munitions. Therefore it is your duty—*your patriotic duty*—to attend. And don't forget your superintendents and foremen. Give them an opportunity to go to Boston. It will make them bigger men and it will equip them to assume greater responsibilities. Others have profited by this experiment and you likewise will be the beneficiary.

Flag-Raising Celebrates Opening of New Plant

Description of the Recently Completed Works of the E. J. Woodison Co. for the Manufacture of Foundry, Platers' and Polishers' Supplies

TO CELEBRATE the completion of its new plant for the manufacture of foundry, platers' and polishers' supplies and equipment, the E. J. Woodison Co., Detroit, recently had a flag-raising on the roof of the main building, as shown in the accompanying illustration. The flag was purchased by the employes of the company and was presented to E. J. Woodison in commemoration of the event. In response to the presentation, Mr. Woodison delivered a patriotic address.

The new plant is built on a site of 1¼ acres on St. Aubin avenue and is well provided with shipping facilities. The main line of the Grand Trunk railroad parallels the rear of the property and here is also located Milwaukee Junction, which affords connections with the Michigan Central, Lake Shore, Pere Marquette and Wabash railroads. The plant has a storage capacity for 250 carloads of material and provides an area of 50,000 square feet of floor space and 3900 feet of sidetrack serve the various departments. One of the two side tracks parallels the manufacturing building, the main structure and the firebrick storage on one side, and the other spur extends the length of the main building and brick stock house on their opposite sides. In addition, wide driveways parallel both sidings and serve the manufacturing departments and the main building.

FLAG-RAISING ON THE ROOF OF THE MAIN BUILDING OF THE NEW PLANT OF THE E. J. WOODISON CO., DETROIT

The manufacturing plant is a brick structure, 24 x 300 feet, two stories high. Manufacturing is carried on in the basement, each department being separated by fire doors and walls, and all materials are delivered to this department from the floor above by the gravity system which minimizes handling. In the basement, a large section is devoted to the manufacture of all sizes of wax vent wire. Adjoining this section is the parting compound department with a capacity of 1000 barrels per month. The raw materials are stored on the floor above and are delivered to this department by gravity. Platers' and polishers' supplies are manufactured in the adjoining section and in the next department are two 10,000-gallon tanks for the storage of vegetable oils, used in the manufacture of liquid core compound. Here also are located measuring tanks and motor-driven pumps used for the delivery of oil from tank cars for storage or for delivery to the kettles in the next section. Other motor-driven pumps are provided for delivering the vegetable oils from the kettles to the storage tanks on the main floor. The liquid core compound is boiled in four kettles which have a capacity of 140 barrels of compound per day.

On the main floor are 11 storage tanks with a capacity of 260 barrels of finished material. These tanks are so elevated that barrels or steel drums can be placed underneath them and filled direct from the tanks. Pumping facilities are provided on the siding paralleling the building for unloading cars of vegetable oils and for filling the tanks in the basement. Manholes also are conveniently located for emptying barrels of oil into the storage tanks in the basement. In the yard adjoining the liquid core compound department are two 8000-gallon oil storage tanks and immediately adjoining is a yard which has a capacity for storing several hundred barrels of rosin.

On the opposite side of the track, paralleling the manufacturing plant, is the fire brick storage, 40 x 125 feet, and 22 feet high. Providing for aisles and by piling the brick 10 feet high, this storage has a capacity of 700,000 fire brick, tile and cupola blocks.

The main building is of fireproof construction and is built of brick and concrete throughout. It is 120 x 300 feet and is devoted largely to the storage of bulky materials and miscellaneous foundry supplies. The basement is divided into 30 concrete bins for the storage of such materials as fire clay, fluorspar, brass core and sand-blast sands. A continuous monorail trolley serves all of these bins and carries a 1-ton bucket which delivers its contents to a boot at the end of the building and is elevated by an electrical hoist which dumps the contents into a hopper leading to the outside of the building where the wagons and motor trucks are loaded. A 5-ton elevator carries materials from the basement to the main floor and this likewise is employed to serve the other floors. The bulky materials for storage in the basement are unloaded direct from the cars to the bins by means of openings on each side extending the entire length of the walls.

On the main floor, foundry facings, dry core compounds and similar materials are stored. On the next floor is located the storage for miscellaneous foundry supplies and equipment, and here also has been provided a well-equipped machine shop for the manufacture of electrically operated jar-ramming, roll-over molding machines, air squeezers, brass furnaces and other foundry equipment. A large section of this floor also is devoted to the manufacture of perforated chaplets and in the wood-

working department snap flasks, skim gates, floor rammers and other foundry accessories are produced. In the front end of this building are located the offices which are laid out on the individual unit plan, offices being provided for each member of the executive staff, local sales force and other departments.

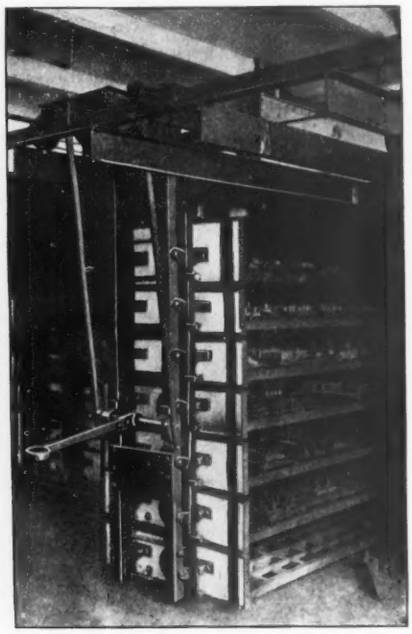
A large garage, 30 x 44 feet, also is on the property, which is equipped with machinery for making repairs on motor trucks, and tanks for the storage of gasoline and oil.

In addition to this large plant and warehouse, the E. J. Woodison Co. maintains the following branch warehouses: Toronto, Ont., with an area of 20,000 square feet of floor space; Buffalo, with an area of 17,000 square feet; Boston, with 16,000 square feet; Seattle, with 18,000 square feet, and Portland with an area of 5000 square feet. In addition, large stocks of foundry supplies and equipment are carried in warehouses located at Montreal, Que., and Windsor, Ont. Offices also are maintained in Cleveland, Indianapolis and St. Louis.

The officers of the E. J. Woodison Co. follow: President, E. J. Woodison; vice president, C. H. Woodison; treasurer and sales manager, C. D. Yahne, and secretary, J. C. Woodison.

Improved Core Oven

Improvements in the method of supporting the drawers of sectional core ovens have been developed by the Foundry Equipment Co., Cleveland, which permit the employment of standard drawer-type core oven construction with trays much larger than those customarily used. In the improved construction the double-suspension, overhead trolley, which may be seen in the accompanying illustration, supports the front ends of the drawers at two points, holding each drawer rigidly in place when it is withdrawn, and it is said, preventing sagging or swaying. The trolley travels on overhead steel beams which are anchored in the masonry of the oven. The drawers are engaged for withdrawal singly or in groups by turning a star-wheel handle which operates a separate latch for each tray. An automatic safety device prevents the trolley from releasing the drawers. This arrangement permits any one drawer or combination of drawers to be withdrawn as desired. The rear ends of the drawers are carried on differential rollers. When the drawers are pushed into the oven for baking, the front ends are allowed to rest upon the steel construction of the oven front. Ovens equipped with the new type drawer suspension have been built by the Equipment company with trays 4 feet wide and nearly 9 feet long.



IMPROVED DRAWER SUSPENSION PERMITS ALMOST ANY SIZE CORE OVEN DRAWERS TO BE USED

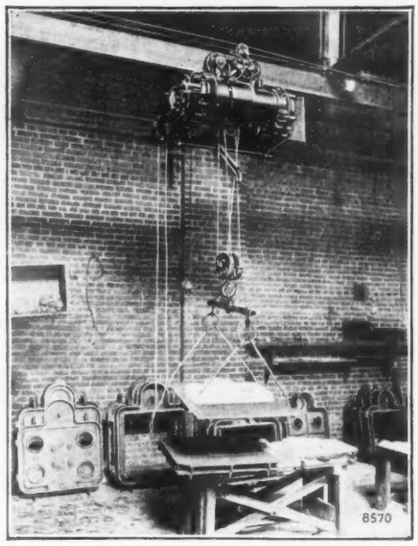


FIG. 1 — ELECTRIC HOIST HANDLING CORES IN A FOUNDRY

Resumes Manufacture of Hoists

The Link-Belt Co., Chicago, recently announced its intention of resuming the manufacture of electric hoists and will specialize in hoists ranging in capacity from 1000 to 6000 pounds. These machines, which will be manufactured at its Philadelphia plant, can be adapted for either direct or alternating current and are fitted with plain, hand-geared, cord-operated motor, or a cage-operated motor trolley. Fig. 1 shows a direct current, plain trolley hoist handling boiler cores in a foundry before the cores have been baked. The hoist employes a dynamic braking system in which the descending load drives the hoisting motor as a generator and uses it for a brake. This type of brake permits work of a delicate nature, such as the lowering of cores, to be handled with comparatively little danger of breakage from sudden shocks. All parts of the hoist are enclosed, but they can readily be made accessible. By removing a sheet steel cover the hoisting drum and controller may be reached and by removing the heads of the end housings the spur gears are exposed and may be slipped off the shafts. The cut steel gears run in oil and automatically splash lubricate the bearings. Fig. 2 illustrates a hoist handling a large pulley in a pulley manufacturing plant.

Personal

C. Albert has been appointed manager of the Southwark Bronze Co., Philadelphia.

Wm. Maginness has been appointed manager of the Christiana Machine Co., Christiana, Pa. The capacity of this plant is to be extended by the erection of an addition.

Van Buren Ropke has been elected vice president and general manager of Grainger & Co., Louisville, Ky., founders and machinists, succeeding the late W. C. Brohm.

H. D. Kenney has resigned his position as general manager of the Humphryes Mfg. Co., Mansfield, O., to become president of the Kenney-McGreevy Foundry Co., Mansfield.

E. G. Irwin, manager of the Cincinnati office of the Asbestos Protected Metal Co., Pittsburgh, has joined the

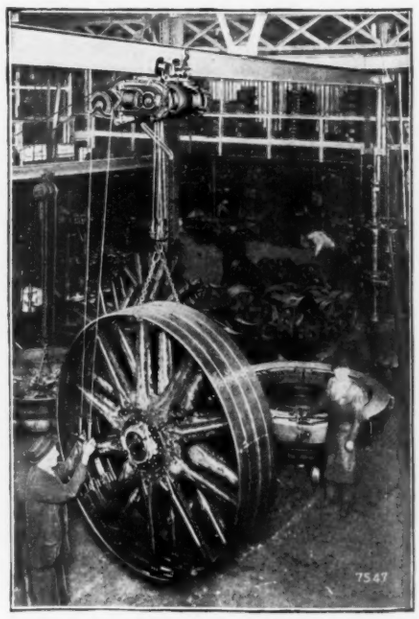


FIG. 2 — HOIST HANDLING A LARGE PULLEY IN AN ERECTING SHOP

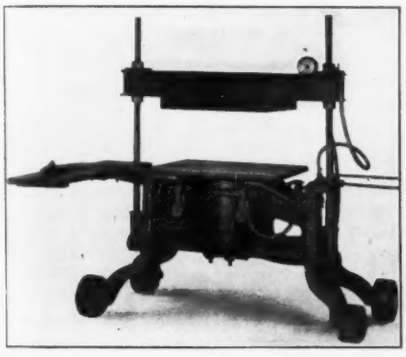
Ohio national guard and this office, therefore, has been closed temporarily.

C. D. Smith has resigned as foreman of the foundry operated by the Davis Foundry & Machine Co., Rome, Ga., to accept a similar position with the Southern Iron & Equipment Co., Atlanta, Ga.

B. M. W. Hanson has resigned as vice president and works manager of the Pratt & Whitney Co., Hartford, Conn., to accept a similar position with the Colt's Patent Fire Arms Mfg. Co., Hartford.

J. H. Jewett, formerly sales manager of the Ingersoll-Rand Co., New York, has been elected vice president and has been succeeded by L. D. Albin, formerly assistant general sales manager, who has been appointed manager.

Robert Ball, manager of the foundry operated by Butterworth & Lowe, Grand Rapids, Mich., was elected secretary of a new organization of foundrymen of western and southern Mich-



SLEEVE VALVES AND LEATHER PACKING ARE FEATURES OF THIS JOLT AND SQUEEEZE MACHINE

igan, formed at the Hotel Pantlind, Grand Rapids.

J. T. Mercer, formerly superintendent of the plant of the American Engineering Co., Philadelphia, has resigned to accept the position of works manager of the Deemer Steel Castings Co., New Castle, Del. William L. Fahnstock succeeds Mr. Mercer as superintendent of the American Engineering Co.

G. G. Reiss, formerly affiliated with the estate of P. D. Beckwith, Dowagiac, Mich., has been appointed superintendent of the new plant of the Minnesota Furnace Supply Co., St. Paul. A new foundry recently has been built by this company for the production of castings for furnaces and heaters.

Walter A. Janssen, superintendent of the steel foundry of the Bettendorf Co., Davenport, Ia., has resigned. On Saturday night, Aug. 18, he was the guest of honor at a banquet tendered to him by his former employes and as an expression of their good will and esteem they presented him with a gold watch and diamond ring. Mr. Janssen is a director of the American Foundrymen's Association and is chairman of its committee on steel foundry standards. His future affiliation has not yet been announced.

Alfred L. Holmes and C. M. Goldman have been added to the sales organization of the Pangborn Corporation, Hagerstown, Md., manufacturer of sand blast equipment. Mr. Holmes will be placed in charge of the Cleveland office of this company and Mr. Goldman will be district sales agent at Philadelphia.

Sleeve Valve Molding Machine

The use of a simple sleeve-valve which is so designed that air is admitted to the jolting cylinder during only a portion of the period of operation is a feature of a new combination jolt-ramming and squeezer machine built by the Federal Foundry Supply Co., Cleveland. The two cylinders for jolting and squeezing are concentric. The inner, or jolting cylinder, is so arranged that the piston acts as a slide valve and cuts off the supply of air when the table approaches the top of its travel. In this position, the exhaust port is opened, allowing the table to drop. This arrangement of valves is designed to economize the consumption of air. The piston operating in the outer cylinder, which is used for the squeezing operation, is supplied with a leather ring, which is held in place by a large steel washer. When air is admitted to this cylinder, it expands the leather against the walls thus reducing the leakage to a minimum. An adjustable regulating valve is provided which may be set to maintain any desired squeezing pressure. The head of the machine is carried by side rods which turn on bearings held in position by an extension of the squeezing cylinder casting. This arrangement eliminates squeezing stresses from the frame of the machine. As may be seen from the accompanying illustration, the machine is provided with knee valves for the operation of the vibrator and squeezer.

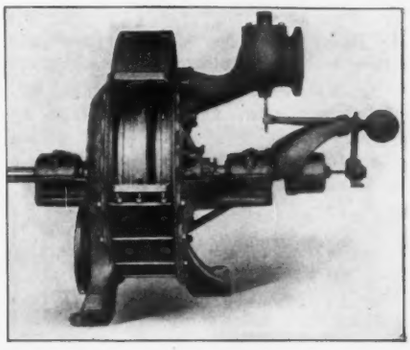
New Turbine for Driving Blowers

A series of new steam turbines suitable for use in foundries and power plants has been developed by the General Electric Co., Schenectady, N. Y. The new turbines, which are of the Curtis impulse type, are built in several capacities. The number of stages and rows of buckets vary with the capacity. When used with blowers, centrifugal fans and similar equipment, the speed of the turbine may be adjusted by means of a hand wheel while the machine is in operation. A constant running speed is maintained by a double-balanced, piston-valve throttle. A split wheel-casing, shown in the accompanying illustration, is used to permit the inspection of the buckets, which are made of bronze and are dovetailed into the wheel. The main shaft of the turbine, which runs in babbited bearings with renewable linings, is fitted with accessible packing glands. To secure rigidity, the frame of the turbine is mounted on three feet. This construction also serves to keep the bearings in line.

Melting All-Scrap in Electric Furnace

(*Continued from page* 405)

paratively short time, although the 5-ton furnaces have been producing low phosphorus pig iron and washed



CURTIS STEAM TURBINE WITH PORTION OF CASING REMOVED

metal for some months. A small core oven and a dry-sand mold oven are under construction. Fig. 16 shows the general arrangement of the foundry and the position of the furnaces and molding floor.

The largest steel casting which has been poured up to the present, is a 5700-pound roll. The smallest steel casting that has been made weighs 9 pounds. The records made so far in making gray iron castings include one weighing 1450 pounds and one weighing less than ½ pound.

For commercial purposes, the furnaces are being built in four different sizes—1½, 3, 5 and 10 tons.

The officers of the Ludlum Electric Furnace Corp. are H. D. Batcheller, president; Edwin Corning, treasurer; Thornton W. Price, vice president and consulting engineer. The general offices are at Watervliet, with a branch in the Woolworth building, New York.

The Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., manufacturer of conveying and elevating machinery, has established an export department at 30 Church street, New York.

WHAT THE FOUNDRIES ARE DOING

Activities of the Iron, Steel and Brass Shops

J. C. Higgins, San Diego, Cal., will erect a brass foundry and machine shop.

The Modern Foundry Co., Cincinnati, will build an addition to its plant, 80 x 200 feet.

The Duluth Iron Works, Duluth, is building a foundry.

Plans are being prepared for a brass foundry to be erected for the Mueller Mfg. Co., Sarnia, Ont., at a cost of $100,000.

The foundry of the Gross Mfg. Co., West Hazleton, Pa., is being extended and a new pattern shop is being erected.

H. C. Trout, 226 Ohio street, Buffalo, plans the erection of a 52 x 83-foot foundry and a 40 x 50-foot blacksmith shop.

A machine shop, 106 x 400 feet, will be erected by the Aluminum Castings Co., Detroit, at a cost of $400,000.

The Sivyer Steel Casting Co., Milwaukee, will greatly enlarge its plant and will install a three-ton electric furnace.

The Cope Pattern Works & Foundry Co., Detroit, will erect a 1-story plant at 111 Wight street, to cost $32,000.

An addition, 40 x 60 feet, will be built to the foundry of the Specialty Brass Co., Kenosha, Wis.

The Belle City Mfg. Co., Racine, Wis., is erecting a foundry and wood shop at a cost of $25,000.

The Flint Foundry Co., Flint, Mich., will build a 50-ton foundry. F. L. Carpenter is manager.

The Akron Rubber Mold & Machine Co. contemplates the erection of a foundry at Barberton, O.

A contract has been awarded for the erection of a $25,000 foundry, 75 x 200 feet, by the Driver-Harrison Co., Harrison, N. J.

An addition to the foundry of the Muskoka Foundry Co., Bracebridge, Ont., will be built at a cost of $15,000.

The Eagle Brass Foundry, Seattle, is erecting a two-story, 90 x 105-foot plant at a cost of $10,000.

A. H. Burchard, Pontiac building, St. Louis, is in the market for malleable foundry and pattern shop equipment.

The Edward Valve & Mfg. Co., Chicago, contemplates the erection of a steel foundry, 80 x 100 feet, to cost approximately $30,000.

D. H. Redmond, Philadelphia, and others have incorporated the Hamburg Foundry Co., Hamburg, Pa., with a capital stock of $50,000.

The Wilcox, Crittenden Co., Middletown, Conn., will build a 40 x 90-foot foundry, of steel and reinforced concrete construction.

The American Hardware Corp., New Britain, Conn., will erect a new foundry to replace the one recently destroyed by fire.

The Marine Pipe & Machine Works, 579 Railroad avenue, Seattle, will erect a two-story foundry and machine shop at a cost of $15,000.

The Bolles Iron & Wire Works, 288 East Milwaukee avenue, Detroit, is building a $6000 addition to its foundry and boiler room.

The Independent Foundry Co., West Allis, Wis., will erect a gray iron foundry, 75 x 110 feet, at a cost of $20,000, to be located at Fifty-fourth avenue and Burnham street.

The Peoria Malleable Castings Co., Peoria, Ill., has purchased a 16-acre site on which it is erecting two buildings, respectively 120 x 200 feet and 100 x 220 feet.

A contract has been awarded by the Maryland Brass & Metal Works, Baltimore, for a foundry, 46 x 90 feet, to cost approximately $15,000.

The Hamilton Foundry & Machine Co., Hamilton, O., contemplates the erection of an addition to its plant to cost approximately $5000.

Contracts have been awarded by the Thompson Mfg. Co., Lancaster, N. H., for the erection of a 34 x 52-foot foundry to cost $20,000.

The American Die Molded Casting Co., Chicago, has been incorporated with a capital stock of $5000 by Paul J. Keck, Ignatz Lowey and Leonard H. Wolf.

The Calumet Machine & Casting Co., Chicago, has been organized with $250,000 capital stock by Harry Lewis and Samuel C. Rowland.

The Lake Charles Iron Works, Inc., Lake Charles, La., has been formed by the consolidation of the Warren Machine Works and the Leesville Iron Works, Leesville, La. A new foundry and machine shop will be built.

A company has been organized by A. W. Snyder, formerly of Burlington, Wis., to engage in the manufacture of castings and automobile parts in Milwaukee. Plans have been prepared for a two-story, 120 x 240-foot plant to cost approximately $75,000.

The Empire Stove & Furnace Co., Owen Sound, Ont., has been incorporated to engage in the manufacture of stoves, furnaces, radiators and castings. The new company is capitalized at $100,000 by Archibald A. Parks, Abraham J. Creighton and Edgar W. McQuay.

The Nicu Steel Corp., Toronto, Ont., has been incorporated with a capital stock of $200,000 to conduct foundries, iron and steel plants, etc. The incorporators are Donald R. Hossach, 44 King street west; Joseph M. Gordon, Alicia Hill and others.

Stanley F. Kadow, architect, 988 Kinnickinnic avenue, Milwaukee, has prepared plans for a foundry and machine shop to be established in Cudahy or St. Francis. The main building will be 80 x 163 feet, with a wing, 20 x 163 feet. The name of the owner is withheld.

A company has been formed by St. Louis and Alma, Mich., interests to purchase the stock of the Standard Foundry Co., St. Louis, Mich. Officials of the Republic Truck Co., Alma, own a majority of the stock and castings for the Republic company will be the principal product. The capacity of the plant will be more than doubled.

The Kenney-McGreevy Foundry Co., Mansfield, O., recently incorporated with $20,000 capital, has purchased the plant of the Phoenix Electric Co., which it will remodel. H. D. Kenney is president of the company; Joseph Paule, vice president; Andrew Kass, second vice president; Hugh McGreevy, secretary and Jacob Cousins, treasurer.

The Temple Malleable Iron & Steel Co., 312 Harrison building, Philadelphia, will erect the following buildings at its plant in Temple, Pa.: One-story office building, 50 x 46 feet; carpenter and pattern shop, 36 x 90 feet; locker building, 41 x 52 feet; power house, 60 x 81 feet; shipping and annealing building, 95 x 236 feet; malleable foundry, 156 x 285 feet; hard iron building, 36 x 170 feet and a sand shed, 24 x 115 feet. The cost of this construction will be approximately $500,000.

The Lewis Electric Welding & Mfg. Co., Toledo, O., was incorporated recently with $100,000 capital to take over the business of the Lewis Foundry Co. A new building, 36 x 120 feet, has been erected and a building, 36 x 100 feet, is nearing completion. Several thousand dollars will be expended for equipment. The company is specializing in the production of semi-steel cast head valves for gas, gasoline and oil engines and upon the completion of the extensions will be able to double its present output.

New Trade Publications

OXY - ACETYLENE WELDING AND CUTTING APPARATUS.—An 8-page bulletin published by the Prest-O-Lite Co., Inc., Indianapolis, illustrates and describes the complete line of apparatus manufactured by this company for oxy-acetylene welding and cutting. Not only is the equipment shown, but all of the accessories required for this work are illustrated and described.

FOUNDRY EQUIPMENT AND SUPPLIES.—One of the most comprehensive catalogs yet published, devoted exclusively to foundry and platers' equipment, supplies and accessories, has been issued by the E. J. Woodison Co., Detroit. It contains 560 pages in addition to a well arranged 16-page index. This catalog will prove a valuable addition to the trade library of every foundry and plating plant. The introductory pages are unique, as they contain the individual portraits of the entire Woodison organization. The catalog is well arranged, beginning with sand, and is followed by facings, core compounds, core binders, parting compounds, fluxes, alloys, etc. Succeeding pages are devoted to small foundry supplies, such as brushes, riddles, rammers, bellows, shovels, forks, sprayers, chaplets, mallets and other small supplies required by every foundry. A number of pages are devoted to flasks, steel bottom plates, clamps and follow boards, and this is succeeded by equipment for the sand-blast room. Several pages are devoted to ladles, cupolas, blowers, etc., and one section is devoted to equipment for the core room. Hoists of various types are illustrated, as well as machinery for the pattern shop. The cleaning room is not overlooked and includes such equipment as sand-blasts and tumbling mills, as well as air compressors for furnishing air for the various foundry departments. Molding machines, fire brick and cupola blocks are featured. This work also contains a complete catalog of platers' supplies and equipment, 154 pages being devoted to this section. In addition, the catalog contains many valuable tables, hints and suggestions for gray and malleable iron, steel and brass foundrymen, as well as for polishers and platers.